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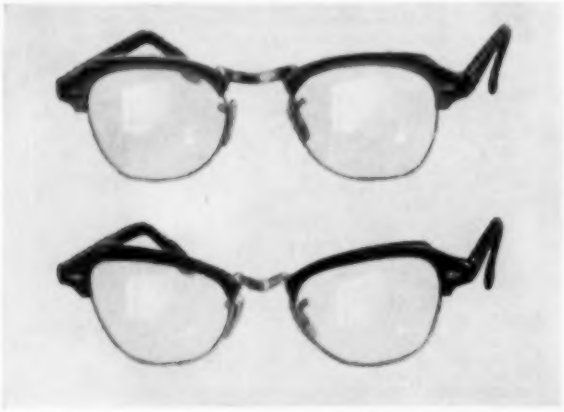

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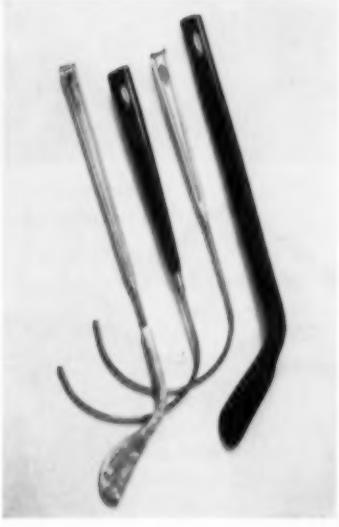

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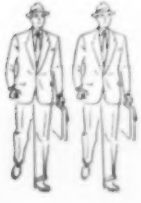

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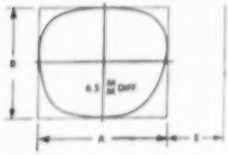


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|---|---|---|---|
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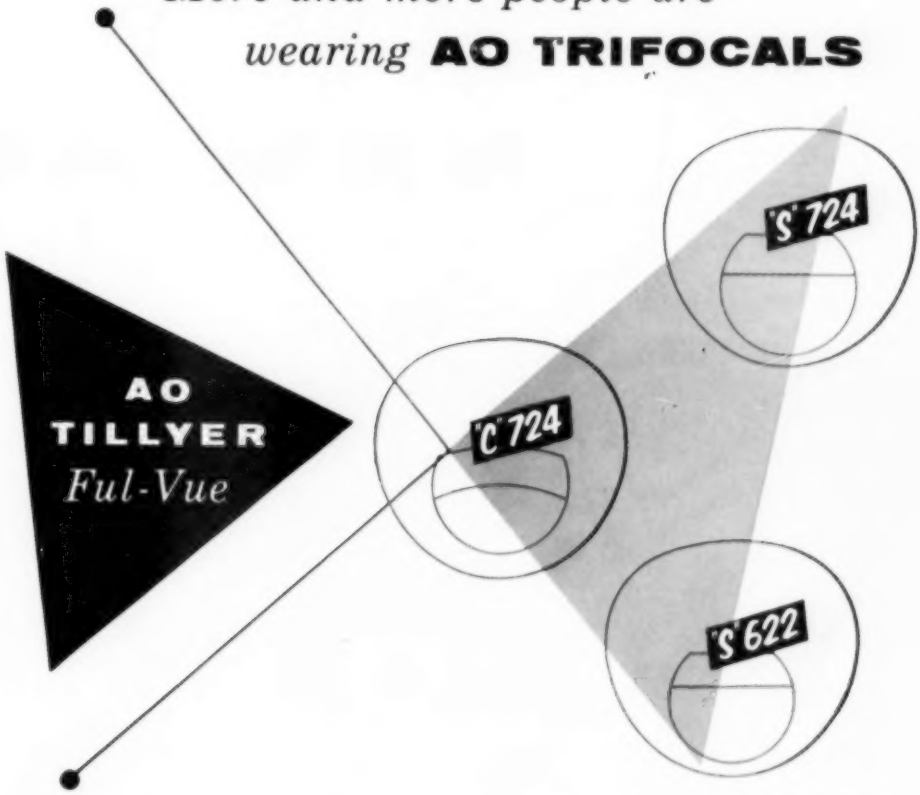


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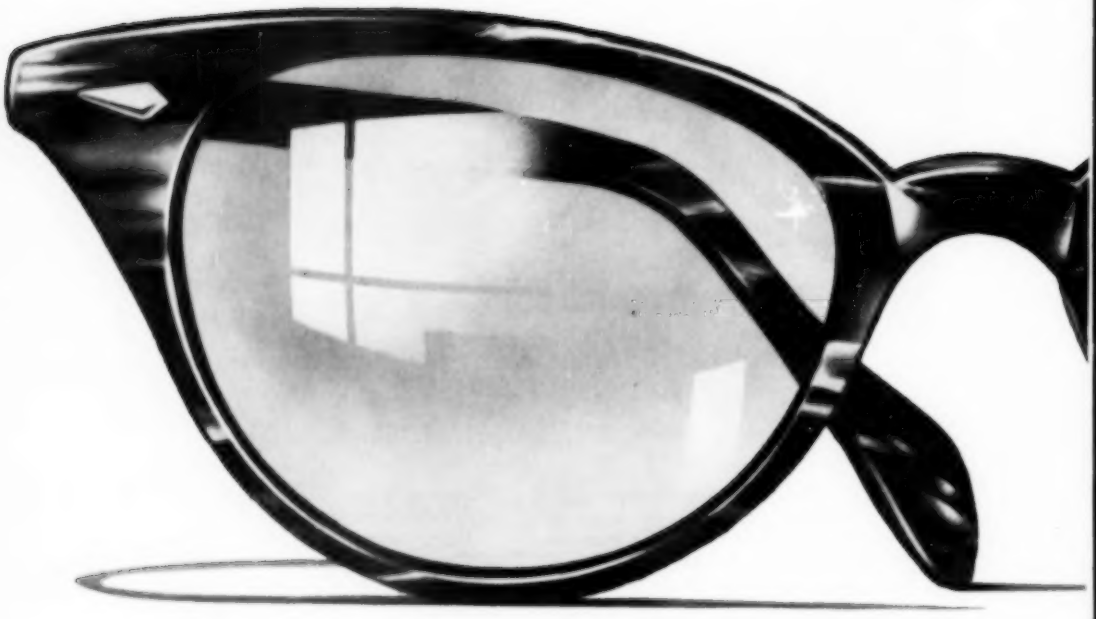

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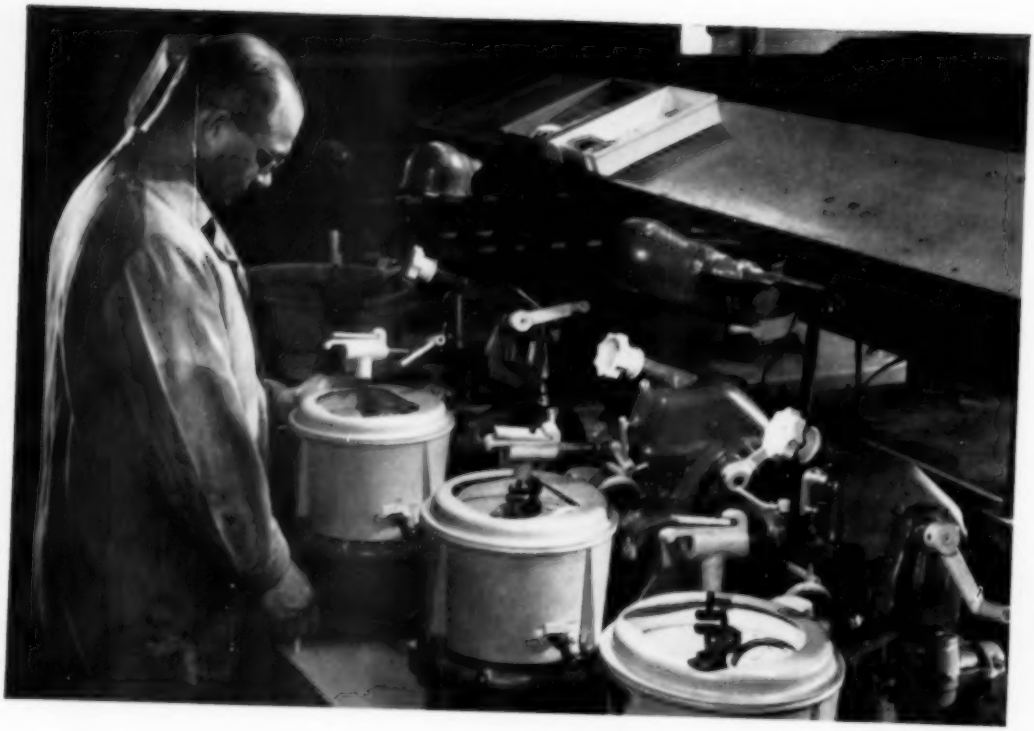

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1955

## AMERICAN ACADEMY OF OPTOMETRY

PRESIDENT

1955

John D. Perry, Jr.

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AMERICAN ACADEMY OF OPTOMETRY

Vol. 32 January, 1955 No. 1

# PREDICTING THE SUCCESS OF TRAINING AMBLYOPES*

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Columbus, Ohio

## INTRODUCTION

The purpose of this report is to summarize our attempts to predict, prior to a visual training program, the precise amount of improvement in visual acuity that can be attained by certain patients whose visual acuity through correcting lenses is less than 20/40.

A visual acuity of 20/40 or less is defined by Burian[1] as a clinically significant impairment. Among the causes of such reduced acuity may be included pathology, toxicity, congenital anomalies and disuse. Of these, we shall be concerned only with amblyopia of disuse. Burian[1] defines this as a reduction in visual acuity in one eye which may be reversed by appropriate means, and for which no ophthalmoscopically demonstrable cause can be found.

For the present investigation it was necessary to sift through the available case reports of reduced acuity and select those which indicated the possibility of being reversed. Any patient with a known cause for the reduced acuity such as pathology or toxicity was not included.

## SCREENING PROCEDURE

The screening procedure consisted of the following diagnostic tests: (1) A complete refraction. (2) Visual acuity through a pinhole disc to be sure the reduced acuity was not attributable to a refractive anomaly. (3) A detailed peripheral and central visual field examination. (4) An ophthalmoscopic examination to eliminate the possibility of the lowered acuity being due to a lesion or congenital anomaly. (5) An off-foveal-fixation examination using the after-image-transfer and Lowe's ring test to single out this type of lowered acuity, and (6) Squint analysis. Following the pretraining analysis we acquired data

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This is the Bing Memorial Award paper for 1954. Awarded annually to the senior student or students presenting the best paper describing original research in visual perception.
†Optometrists. Former members of the 1954 graduating class of the School of Optometry, The Ohio State University.

for each patient on the experimental screening apparatus devised by Miller.

THEORY OF APPARATUS

Miller[2] obtained evidence that an amblyopic eye shows extensive irradiation and spatial summation at the fovea. This occurs in the normal eye when short flashes are used, but the normal eye apparently has a mechanism which counteracts or prevents irradiation when the target is exposed continuously.

When increasing widths of an illuminated slit are presented to an amblyopic eye, the brightness difference threshold is found to continue to decrease over a greater range of slit widths than in the case of the normal eye. That slit width at which no further change in the brightness difference threshold occurs is known as the index of blurredness $\phi$. In the case of the amblyopic fovea it is a measure of the combined effects of optical blurredness and the irradiation of excitation from one retino-cortical pathway to adjacent pathways.

For predicting the improvement of visual acuity of the amblyope, the criterion of the index of blurredness was used. If the visual acuity of the amblyopic patient was at the level at which the index of blurredness indicated it ought to be, it was assumed that no improvement in visual acuity could be expected from training. However, if the index of blurredness was lower than the value found to be in accord with the manifest visual acuity, then it was predicted that such an amblyope could be trained to the point where the visual acuity and the index of blurredness would be commensurate.

The Miller apparatus used in our work consists of a fixation target (Figure 1A) and a testing target (Figure 1C) having a constant background luminance and a variable illuminated slit. When measuring the acuity of the amblyopic eye, the fixation target, consisting of two illuminated dots on a dark background, was viewed with the good eye in order to maintain constant fixation. The patient was instructed to fixate between the dots. The test target was adjusted so that when the slit was seen it appeared aligned with the fixation dots as shown in

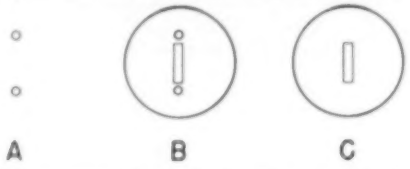


Fig. 1. Targets used in measuring the acuity of an amblyopic eye. A represents the fixation points presented to the good eye. B represents the binocular combination of the two targets. C represents the test target.

Figure 1B. This procedure insured that the image of the slit fell at the center of the fovea of the amblyopic eye. This is true since the correspondence between the two eyes was normal in all cases.

When measuring the acuity of the good eye, the amblyopic eye was occluded and the test target was exposed to the good eye. In this case the subject fixated an imaginary point at the center of the test target.

The testing target was set up so that the visual angle of the illuminated slit subtended at the entrance pupil could be varied by changing the magnification of a system of lenses. As the patient looked between the two dots of the fixation target, the luminance from the light source for the illuminated slit was slowly increased by means of a rheostat until the patient could just see the slit. A series of three readings was taken on the amblyopic and normal eye of each patient for each of several slit widths and the average values were used.

In order to translate variac settings to foot-lamberts produced in the plane of the variable slit, measurements of luminance were carried out with the Macbeth Illuminometer for various variac settings and a calibration curve was drawn. This made it possible to determine the number of foot-lamberts of luminance required for the patient to be able to just see the testing slit.

Therefore, we were able to plot the brightness difference threshold in foot-lamberts against the number of minutes of visual angle on log-log paper as shown in Figure 2. For small slit widths the data can be fitted with a straight line having a slope of minus one, and for large slit widths with a horizontal straight line. The abscissa of the point

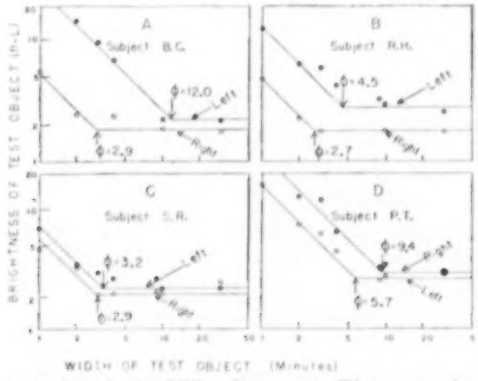


Fig. 2. Data obtained with the Miller Apparatus. The curves show the just perceptible difference in luminance for various slit widths.

of intersection may be used as the index of blurredness $\phi$. This is identical with the method used by Miller[2] for evaluating $\phi$.

The predicted improvement of the visual acuity in the amblyopic eye can be calculated by setting the ratio:

$$\frac{\text{Index of blurredness of good eye}}{\text{Index of blurredness of amblyopic eye}} = \frac{\text{Predicted V. A. of the amblyopic eye}}{\text{V. A. of good eye}}$$

The type of training used in each case is described below in connection with the experimental data. From time to time the visual acuity of the amblyopic eye with the correction in place was measured with a projection chart. The performance was scored in terms of the lowest row of letters on the chart which could be completely read, and the fraction of letters on the next line which could be read. The difference between the denominators of the Snellen fractions for the two lines was multiplied by the fraction and the product was substracted from the larger of the two denominators to obtain a score for the purpose of plotting the data on the graphs in Figure 3.

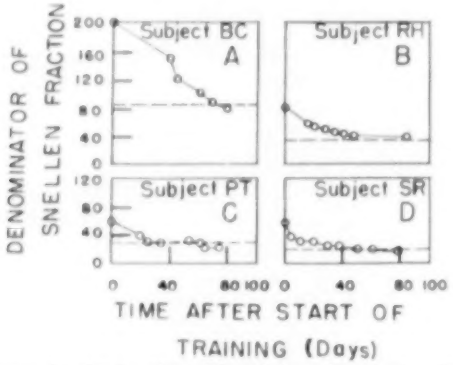


Fig. 3. Improvement in visual acuity with training. The broken line in each graph indicates the final level predicted from the Miller test.

The acuity was measured on one of two charts. No special precaution was taken against memorization of the letters, except that the chart was never viewed from a distance nearer than twenty feet and was seen only once by the good eye.

EXPERIMENTAL DATA

An abbreviated form of each record chart is presented as follows:

Subject: R. H.

Former correction: None. Visual acuity: O.D. 20/25. O.S. 20/200.
Visual acuity with pinhole disc: O.D. 20/20. O.S. 20/80.
New prescription:

O.D. +0.25 D. sph. ⊂ 0.50 D. cyl. axis 75.
O.S. +5.75 D. sph.

Visual acuity with above correction: O.D. 20/20. O.S. 20/80.
Squint: None.
Case History: The subject complained of reduced vision in the left eye. Squint in the immediate family (mother and brother). Has worn glasses intermittently since the age of 9 years.
After-image: Normal.
After-image transfer test for off foveal fixation: Normal.
Lowe's ring test: Unable to obtain valid data.
Perimeter: Normal.
Tangent screen: Normal.
Predicted visual acuity from apparatus: 20/33. The data are shown in Figure 2B.
Training prescribed:

1. Diplopia training on the rotoscope and rotating wheel in conjunction with hand prisms.
2. Fusion training using the stereo-orthopter and rotoscope using similar and dissimilar targets.
3. Pointer technique and the cheiroscopic drawing.
4. Home training.
   a. Wearing eye patch as much as possible.
   b. Tracing, and filling in of newspaper print, starting with the larger print and working down to the smaller type.
   c. Reading the smallest print possible.
   d. Diplopia training with square prisms.

Summary: The subject showed a gradual increase in visual acuity and then a gradual leveling off at the end of 60 days of training. See Figure 3B for an analysis of the progress made in training. The subject approached the actual predicted acuity of 20/33, but remained at a visual acuity of 20/40. The attained visual acuity can be considered as reaching the predicted acuity of 20/33 since the difference of one line is probably within the limits of the accuracy of this experiment.

Subject S. R.

Former correction: None. Visual acuity: O.D. 20/20. O.S. 20/60.
Visual acuity with pinhole disc: O.D. 20/20. O.S. 20/60.
New prescription:
O.D. Plano.
O.S. +0.50 D. sph. ⊂ —0.50 D. cyl. axis 180.
Squint: None.
Case History: The subject complained of reduced vision in the left eye. General health good, but recurring conjunctivitis in the fall and in the spring of the year.
After-image: Normal.
After-image transfer test: Normal.
Lowe's ring test: Shows some degree of false fixation.
Perimeter: Normal.
Tangent screen:
O.D. Displaced blind spot 3 degrees vertically.
O.S. Normal.
Predicted visual acuity from apparatus: 20/22. The data are shown in Figure 2C.
Training prescribed:

1. Diplopia training on the rotoscope and hand prisms.
2. Cheiroscopic drawings.
3. Home training:
   a. Wearing patch as much as possible.
   b. Tracing and filling in of newspaper print.
   c. Wearing a frosted lens over the good eye when not wearing the patch.

Summary: The subject showed a gradual increase in visual acuity (See Figure 3D). The subject attained acuity of 20/20 at the end of 79 days which approximates the predicted acuity.

Subject P. T.

Former correction: None. Visual acuity: O.D. 20/90. O.S. 20/30.
Visual acuity with pinhole disc: 20/60. O.S. 20/30.
New prescription:
O.D. —0.75 D. sph. ⌣ —0.50 D. cyl. axis 90.
O.S. —0.50 D. sph. ⌣ —0.25 D. cyl. axis 180.
Squint: None.
Case History: The subject complained of reduced vision in the right eye. Squint prevalent in the family.
After-image test: Normal.
After-image transfer test: Showed off-foveal fixation.
Lowe's ring test: Unable to obtain valid data.
Perimeter: Normal.
Tangent screen: O.D. Displaced blind spot 6 degrees vertically and 5 degrees laterally, with a 20 mm. white target at 1000 mm.
O.S. Normal.
Predicted visual acuity from apparatus: 20/33. The data are shown in Figure 2D.
Training prescribed:
1. Diplopia training using various instruments.
2. Fusion training using the rotoscope.
3. Pointer technique and the cheiroscopic drawings.
4. Home training:
a. Wearing patch as much as possible.
b. Tracing and filling in of newspaper print.
c. Diplopia training with hand prisms.

Summary: The subject showed a quick improvement and reached the predicted level in about one month (See Figure 3C). After 60 days the acuity was one line better than the predicted level.

Subject B. C.

Former correction: None. Visual acuity: O.D. 20/20. O.S. 20/400.
Visual acuity with pinhole disc: O.D. 20/20. O.S. 20/200.
New prescription:
O.D. +1.25 D. sph.
O.S. +5.75 D. sph. ⌣ —2.00 D. cyl. axis 45.
Squint: None.
Case History: The subject complained of reduced vision in the left eye. Family has history of squint and amblyopia.
After-image: Normal.
After-image transfer test: A slight displacement.
Lowe's ring test: Unreliable.
Perimeter: Normal.
Tangent screen: Normal.
Predicted visual acuity from apparatus: 20/83. The data are shown in Figure 2A.
Training prescribed:
1. Diplopia training.
2. Fusion training.
3. Cheiroscopic drawings.

Summary: The subject showed a gradual increase in visual acuity (See Figure 3A). By the end of 80 days no further increase in visual acuity could be obtained and at this time the visual acuity had increased to 20/70, which is slightly better than the predicted improvement.

Subject C. M.

Case History: The subject complained of reduced vision in the right eye. The right eye showed a lesion in the macular region. Ruled out of the experiment because of pathology.

Subject B. B.

Case History: The subject complained of a sharp pain over the right eye when reading or watching movies. She had undergone surgery for esotropia eight years ago. Light perception in the right eye only in the temporal field. The visual acuity was too low to attempt further investigation.

Subject B. W.

Case History: The subject complained of reduced vision of the left eye. Attributed to trauma at the age of 12 leaving corneal irregularity and lesions in the retina close to the macula.

Subject R. F.

Case History: The visual acuity in the right eye was corrected to 20/30. All attempts to take data on the Miller apparatus proved unsatisfactory. Referred to orthoptics clinic and trained to a visual acuity of 20/20.

Subject J. R.

Case History: The visual acuity of the right eye was 20/200 with correction lenses. Attempts to take data on the Miller apparatus proved unsatisfactory. Lacks motivation and has little time for training.

## CONCLUSION

A total of nine patients were investigated. The motivation and cooperation varied considerably. We were able to predict a probable improvement in four cases. Three cases were ruled out on the basis of pathology. The other two were doubtful because of conflicting sets of data or else the form perception was too low for reliable measurement.

Unfortunately none of the cases were such that the visual acuity and index of blurredness were close enough together that we could predict a non-improvement of visual acuity with training. This type of patient would have provided a control for the experiment. For example if the vasual acuity were 20/200 and the index of blurredness corresponded to a visual acuity of 20/60, we would predict the patient could be trained to a visual acuity of 20/60. However, if both the visual acuity and the index of blurredness correspond to a visual acuity of 20/200, then no improvement could be expected by training.

From the four reports presented no definite conclusion can be drawn as to the precision of the predictions. However, we feel that there is a definite value to be derived from the use of the Miller test.

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# INVESTIGATION OF THE NATURE AND CAUSE OF IMPAIRED ACUITY IN AMBLYOPIA*

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## INTRODUCTION

In a previous investigation[1] new evidence concerning the site and the nature of the processes affected in one type of amblyopia was presented. The present research using more subjects (normal and amblyopic) confirms those findings, and, in addition, gives insight into the physiological processes involved in amblyopia.

Wald and Burian[2] recently reported data which indicated that normal light perception was present in amblyopia. A circular test field subtending a maximum of two degrees and a minimum of one degree was used in testing absolute thresholds foveally and peripherally.

In the author's previous study a narrow bar was used to measure foveal thresholds. It was found that, whereas a disk of one degree in diameter will not differentiate an amblyope from a normal, a narrow bar can uncover an impaired light sense.[1] One is justified therefore in looking for the cause of at least one type of amblyopia in the retina or in the transmission process from the retina to the cortex.

The author has continued to use a rectangle instead of a disk in the present study. The difference between a disk and a rectangle is that in varying the diameter of a disk one is varying not only the area but also the curvature of the border which has been shown by Fry[3] to be an important factor. In varying the width of a narrow rectangle the area or width is the only factor varied, and it is, therefore, more satisfactory for determining the role played by optical blurredness and summation in the physiological sense.

## APPARATUS

Figure 1 shows the apparatus arranged for testing the fovea of an amblyopic left eye. The apparatus consists of a haploscopic device and an acuity meter.

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‡The author expresses appreciation to Dr. Glenn A. Fry whose valuable assistance and advice have made this research possible.

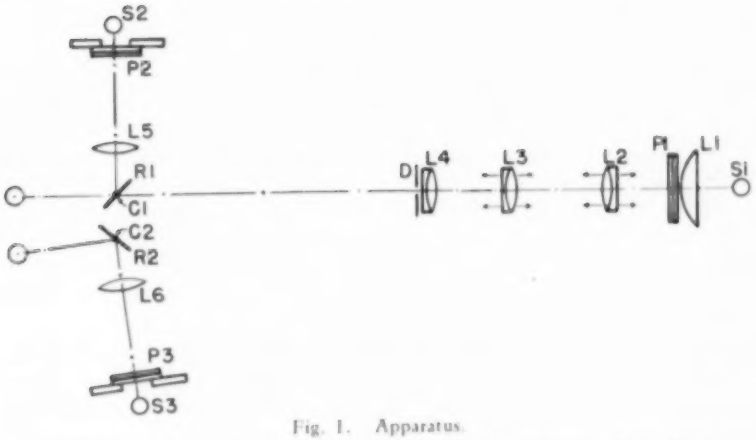


Fig. 1. Apparatus.

The amblyope is tested in the following manner. The left eye observes, through a plate of glass R1 (Figure 1) a bright bar X (Figure 3) in the plane of the diaphragm D (Figure 1). This bar is an aerial image of the target which lies in the plane P1. The target consists of a narrow bright bar on a dark background. This is produced photographically on a lantern slide plate. The emulsion side of the plate is placed in contact with a sheet of white celluloid which is transilluminated by the light coming through the lens L1 from the source S1. The range of intensity is from zero to 12.4 footlamberts.

By changing the positions of two five-diopter achromatic lenses (L2, L3) one can change the size of the aerial image of the pattern at P1. The range of change of size can be further increased by using targets of different sizes. The operator controls the magnification through a system which rotates two identical, non-circular drums (C1 and C2 in Figure 2) oriented in opposite directions. These drums or function generators, designed according to a method proposed by Fry,[4] are connected to the lens carriers D1 and D2 (Figure 3) by wire cables. A heavy spring (SP) opposes the pull of the drums and keeps the cables taut.

The aperture in the diaphragm D (Figure 1), placed immediately in front of the lens (L4) which removes distortion from the magnifying system, is a square the dimensions of which subtend a visual angle of one degree and keeps the vertical angular length of the aerial image of the bar constant at one degree. This bar is seen against a darker background Y (Figure 3a) produced by light from an incandescent

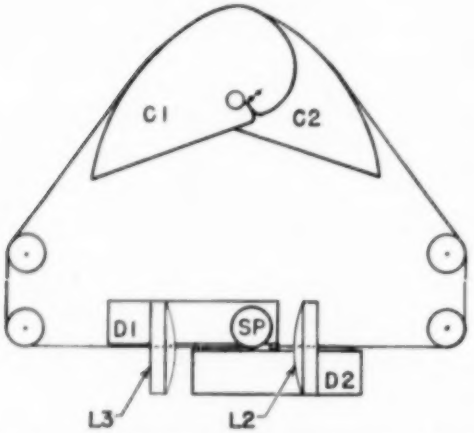


Fig. 2. Mechanism for producing variable magnification.

source (S2, Figure 1) which is diffusely transmitted by two ground glass plates (P2, Figure 1). The circular aperture in the diaphragm immediately behind these glass plates subtends a visual angle of 13.5 degrees at the eye. The lens (L5, Figure 1) forms an image of this aperture behind the eye so that the eye is out of focus two diopters when it is focused on the test object.

The left haploscopic arm is rotated around a vertical axis at the point C1 to make the test object appear centered with respect to the background.

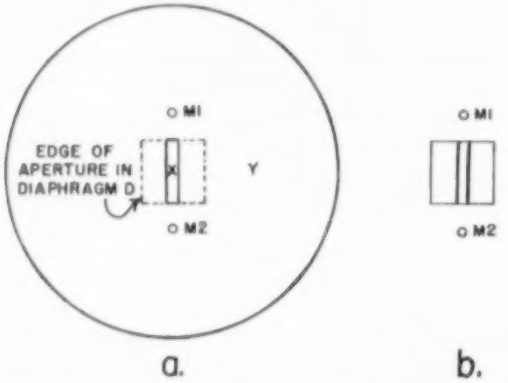


Fig. 3. Stimulus patterns for measuring brightness discrimination (a) and the minimum separable (b).

The pivot point C1 on the haploscopic arm of the left eye which is the one being tested is placed exactly below the axis of the acuity meter. The pivot point C2 of the other arm is displaced laterally to compensate for the interpupillary distance. The normal eye perceives, on a dark background, two white points (M1, M2 in Figures 3a, 3b) which are minute openings in a slide P3 (Figure 1). Images of these two points are formed by the lens L6 and the first surface mirror R2 in a plane one meter behind the right eye. These points are vertically aligned with the bar stimulus by pivoting the right haploscopic arm about the point C2. (Figure 3a) illustrates the binocular appearance of the test stimuli for measuring thresholds.

The thresholds of the normal eye were obtained monocularly. The chin rest was moved sidewise to center the pupil of the right eye on the axis of the acuity meter. A ground glass plate with two black fixation points was substituted for one of the plates at P2 (Figure 1). The arm was rotated around a vertical axis through C1 until vertical alignment was achieved as indicated in Figure 4.

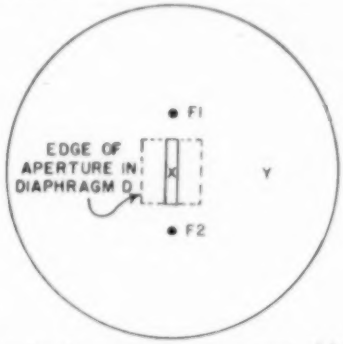


Fig. 4. Stimulus pattern for the monocular measurement of brightness discrimination.

In testing either eye of a normal subject this same arrangement was used except that the ground glass plate containing the two fixation points was moved forward to make the images formed by the lens L5 and the plate of glass R1 fall in the plane of diaphragm D.

This apparatus arrangement was also employed to test the effect of brief exposures of the threshold stimulus with normal subjects. A rotating sectored disk was introduced into the system just in front of diaphragm D (Figure 1) which provided a 0.01 second exposure every second.

The arrangement of apparatus shown in Figure 1 was used to measure visual acuity of the amblyopic eye by introducing the follow-

ing changes. A test pattern of two black one-millimeter bars separated by a one-millimeter interval on a white background was substituted for the threshold test object at P1. An image of this two-bar pattern is formed in the plane of the diaphragm D and appears to the eye as shown in Figure 3b. The intensity of the immediate background of the bars was increased to the maximum, 12.4 footlamberts. Sources S2 and S3 were turned out. The eye being tested fixated the center of the pattern.

The acuity of the normal eye was tested in the same manner.

PROCEDURE

All experiments reported in this paper were performed in a dark room.

The normal and the defective eye were studied separately in each of the five monolateral amblyopic subjects. In testing the fovea of the amblyopic eye, a binocular arrangement was used whereby the normal eye fixated midway between two-point sources of light vertically separated and the amblyopic eye saw the image of the bar test object centered upon its background. The apparatus was then adjusted so that the bar image and the points of light appeared vertically aligned (Figure 3a). The fovea of the amblyopic eye was assumed to be the part of the retina stimulated since all subjects had normal fixation which allowed the image to fall on the fovea regardless of which eye fixated. The fact that all subjects manifested normal correspondence was established by having the subject report when two objects were seen in the same direction. The examiner then used the corneal reflex to determine that the primary lines of sight were pointed toward the objects in question. Correct fixation was carefully maintained throughout the experimentation. No readings were recorded unless the bar image appeared aligned with the two light points.

As will be explained later in connection with the experiments in which homatropine was used, the accommodation in play was carefully measured and controlled. However, in experiments performed without homatropine the only steps taken to control accommodation were the following. The image of the fixation points, formed by the lens L5 in Figure 1, fall at one meter behind the eye and in order for the left eye to be accommodated for the test stimulus at one meter in front of the eyes, it is necessary for the right eye to be out of focus two diopters for the fixation point. Since the subjects were fully corrected, it was not possible for the eyes to relax accommodation to obtain a clear image of the fixation points, and under these conditions one expects about one diopter of accommodation to come into play. This

fact has been demonstrated by Reese and Fry.[5] Awareness of the distance of the target also aided in accommodating the proper amount.

The method of determining thresholds for the amblyopic eye was as follows. One of the larger bar objects was employed to test and to train the subject since the relatively large size made detection somewhat easier. The magnification was then decreased in finite steps and at each step the threshold value was obtained for detecting the bright bar on the bright background. Starting with a subthreshold brightness test object the intensity was increased until the test object became visible. This procedure was repeated five times.

The normal eye was tested in the same manner as the amblyopic one except that the eye being tested fixated an imaginary point midway between two black dots on the white background (Figure 4). When the position of the eye is controlled in this way, the test object when visible is seen with the fovea.

The visual acuity test always immediately followed the brightness difference threshold test. The fixational setting remained the same. The background light was eliminated, and the intensity of the source behind the acuity target was increased to its maximum (12.4 footlamberts). Starting with a subthreshold separation of the black bar on the bright background, the observer increased the magnification until he was able to resolve the two bars.

The two fixation points were actually not necessary for testing the acuity of either the amblyopic or the normal eye. The eyes could see a clear or blurred target which constituted a fixation point. The target in addition provided a stimulus to accommodation as did the outline of the rectangular aperture.

The effect of a periodic presentation of the threshold and acuity test stimuli was determined for several trained observers. Juniors in The Ohio State University School of Optometry, all having normal vision, served as subjects.

The threshold and acuity targets were exposed for 0.01 second by means of a sectored disk and at the threshold the stimulus appeared between the fixation points. These experiments utilized the monocular fixation method as did all other tests of the normal eye. Since the thresholds are affected by the degree of blurredness of the retinal image, it appeared desirable to repeat the experiment using homatropine to control accommodation.

To accomplish this, differential thresholds for different amounts out of focus were determined for the homatropinized eyes of an amblyopic subject. Trial case lenses, ranging from —2.00 D. to +5.00 D.,

were placed immediately behind the artificial pupils of four millimeters diameter to achieve different degrees of blurredness. The subject was positioned by a head and chin rest so that the anterior surfaces of his corneas lay at 15 millimeters from the artificial pupils. The same devices and procedures as described above for testing thresholds of the normal and amblyopic eye were then used to ascertain the particular lens power which yielded the lowest threshold value for each eye, in detecting a bright stimulus subtending a visual angle of 0.51 minutes on a bright background. The intensity of the background in this particular experiment was decreased by a two density filter to test a greater range of blurredness of the retinal image.

SUBJECTS

Mr. D. S. Age 29. Graduate student at The Ohio State University.

Rx. O.D. +5.50 D. sph. ⌒ —0.75 D. cyl. axis 3.
V.A. = 20/60.
O.S. +5.00 D. sph. ⌒ —1.25 D. cyl. axis 180.
V.A. = 20/15.

The patient stated that the vision of his right eye has always been reduced and that whooping cough left his eyes "crossed." At the age of six, glasses corrected the esotropia but did not improve the vision of his right eye. The amblyopia may have been the result of a disease process or could have been congenital and unnoticed by the patient until the time of the disease.

Miss M. C. Age 12.

Rx. O.U. not required. V.A. = O.D. 20/15—2. O.S. 20/70—1.

A pinhole aperture did not improve the acuity of the left eye. The subject became aware of the reduced acuity in her left eye after entering grade school. Various treatments were tried, including visual training recently at The Ohio State University School of Optometry, but no improvement resulted.

Mr. J. M. Age 27. Student at The Ohio State University.

Rx. O.D. +5.75 D. sph. ⌒ —1.25 D. cyl. axis 115.
V.A. = 20/80.
O.S. +2.25 D. sph. V.A. = 20/15.

Intensive orthoptic treatment with occlusion of the left eye for a two-month period produced no improvement in acuity. The subject first became cognizant of his amblyopia at about the age of 14 when a correction was given for his ametropia.

Mr. T. G. Age 30. Graduate student at The Ohio State University.

Rx. O.D. +4.25 D. sph. ⊂ —3.25 D. cyl. axis 175.
V.A. = 20/57.
O.S. +3.75 D. sph. ⊂ —3.25 D. cyl. axis 165.
V.A. = 20/20.

The subject recalls that his right eye has always been considerably poorer than his left one. Glasses have been worn since the age of eight to correct his ametropia and to reduce the large amount of exophoria. Treatment by orthoptics proved to be of no benefit.

Miss I. M. Age 23. Student at The Ohio State University.
Rx. O.D. +3.00 D. sph. V.A. = 20/150.
O.S. +3.00 D. sph. ⊂ —0.50 D. cyl. axis 80.
V.A. = 20/15—2.

An examination at the age of three revealed the amblyopia in the right eye. Orthoptic treatments were given at various ages, including recent training at The Ohio State University Optometry Clinic. Visual acuity, however, always remained reduced.

## RESULTS AND THEORY

The thresholds at the fovea of the normal and the amblyopic eye of each of five subjects are presented in Figures 5, 6, 7, 8, 9. The monolateral amblyopes provided an excellent method for comparing normal and defective responses by excluding any factors of individual difference.

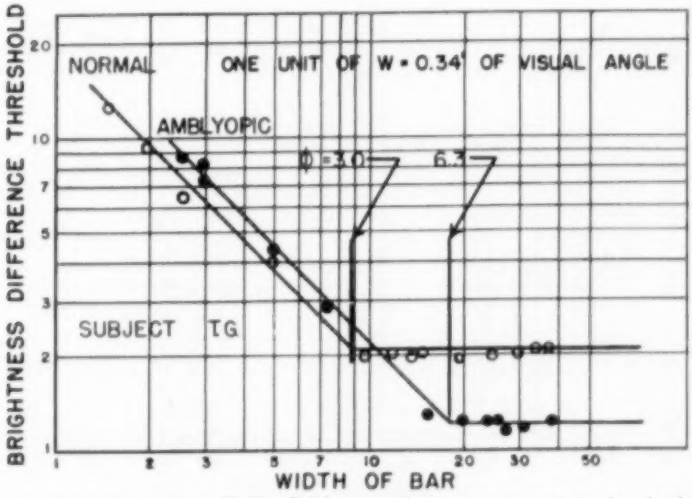


Fig. 5. Data for Subject T. G. Brightness values are expressed in foot-lamberts.

The time required to obtain each threshold curve was slightly over one hour. Only one curve was determined at each session.

It was found that the data of threshold brightness at various widths of the bar image yielded a curve closely resembling an hyperbola. A log scale was then employed and it was found that the data could be fitted satisfactorily with two straight lines, one horizontal and one having a slope of —1.

The curve form has a counterpart in theory. Fry and Cobb,[6] in determining blurredness of the retinal image, calculated that the distribution of light in the image of a narrow line is Gaussian, that changing the width changes the intensity at the center of the image, and that the threshold of visibility is determined by a minimum intensity at the center. Therefore, an increase in width of slit results in a lowered threshold up to a theoretical limit of three to four minutes of visual angle. At this point further increase of slit width, does not affect the threshold. Figure 10 illustrates a theoretical log plot of differential brightness thresholds for a Gaussian image. The form of the experimental curve can be seen to be almost identical with the theoretical one except at the connection of the two lines which in the latter is a curve, Figure 10. When the experimental data conform more closely to the two straight lines this indicates that the distribution of light in the actual retinal image is more rectangular than a Gaussian distribution.

The critical point of the threshold curves in the case of the normal

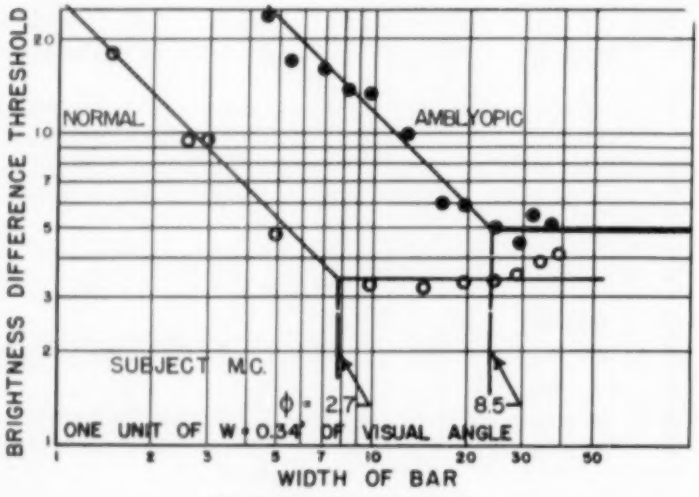


Fig. 6. Data for subject M. C.

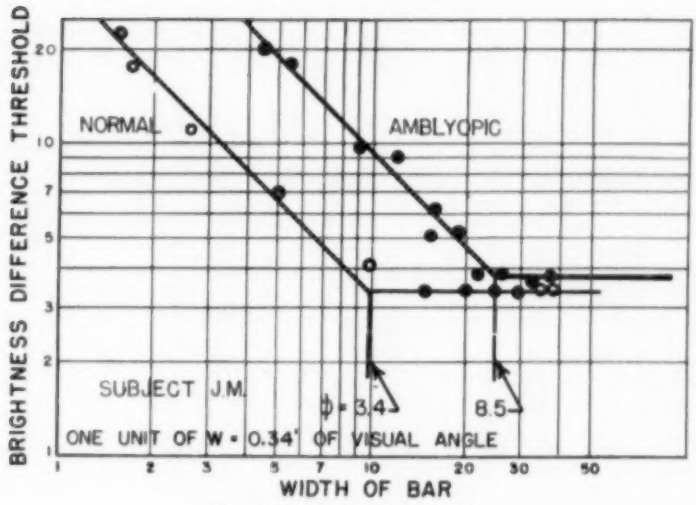


Fig. 7. Data for subject J. M.

eye is the crossing of the pair of lines. Fry[7] has introduced the term "index of blurredness" ($\phi$) to specify this point. In a logarithmic plot the quantitative value of $\phi$ equals the abscissa coordinate of the

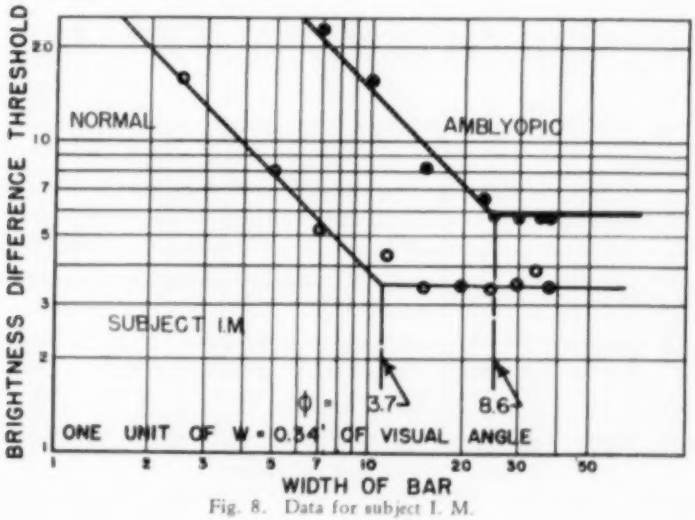


Fig. 8. Data for subject I. M.

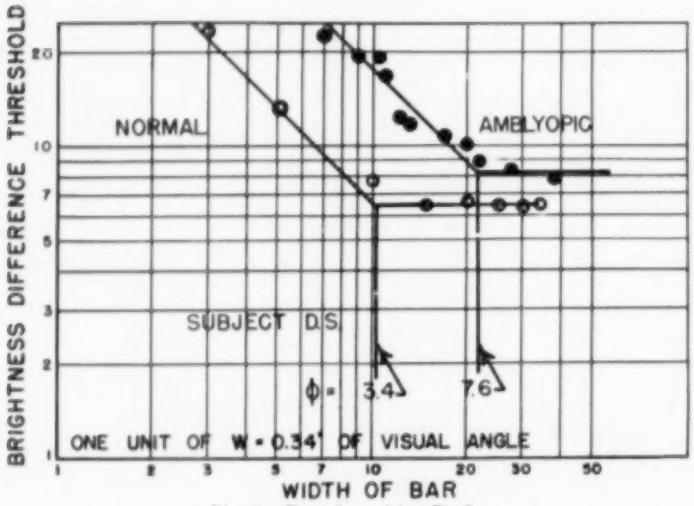


Fig. 9. Data for subject D. S.

point of intersection. The concept of index of blurredness, however, as will be shown, can be broadened to describe the amblyopia curves also.

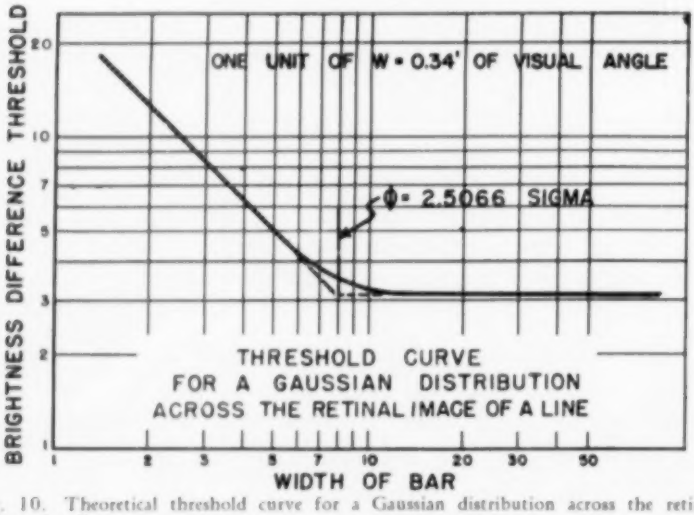
BRIGHTNESS DIFFERENCE THRESHOLD
ONE UNIT OF W = 0.34' OF VISUAL ANGLE
ϕ = 2.5066 SIGMA
THRESHOLD CURVE
FOR A GAUSSIAN DISTRIBUTION
ACROSS THE RETINAL IMAGE OF A LINE
WIDTH OF BAR

Fig. 10. Theoretical threshold curve for a Gaussian distribution across the retinal image of a line.

All of the amblyopic eyes investigated, demonstrated a decrease in threshold with an increase in the bar width considerably beyond the value found for the normal eye. The graphs (Figures 5, 6, 7, 8, 9) show that a leveling off effect occurs in the normal eye when the bar stimulus subtended a visual angle from 2.7 to 3.7 minutes and in the amblyopic eye from 6.3 to 8.5 minutes.

The thresholds for a narrow line thrown out of focus by various amounts were determined for a monolateral amblyope, D. S., whose accommodation was paralyzed by homatropine. The results, Figure 11, show that a +2.00 diopter lens produces, in both the normal and the amblyopic eye, the lowest threshold. The lowest threshold, in turn, reveals the best focus for the stimulus object since the light at the center of the retinal image is at its highest concentration under these conditions. Therefore, at least for one subject, the normal and amblyopic eye were in best focus for the threshold target. There is no doubt that this subject's impaired vision involves more than an optical defect. When homatropine was not used, it is quite likely that the eyes were also in proper focus.

Whether or not this is true, the difference in the threshold curves of the normal and the amblyope cannot be attributed to an optical blurredness of the retinal image.

The lens of best focus (+2.00 diopters) for the homatropinized eyes of the same subject, D. S., was employed to ascertain the differential

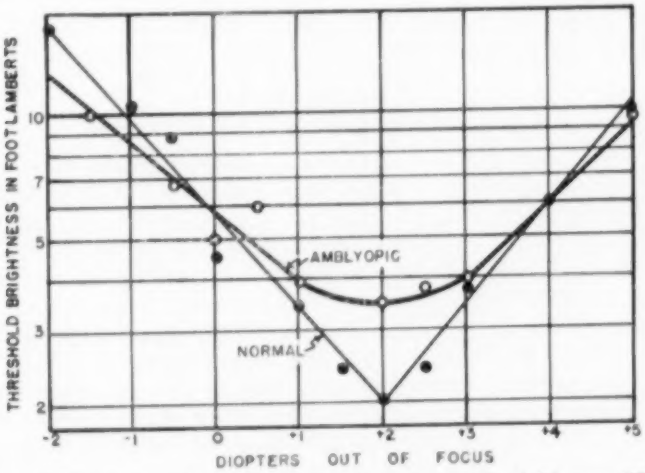


Fig. 11. Effect of throwing the eye out of focus on the brightness difference threshold.

brightness thresholds with the eye (known to be exactly in focus). The resultant threshold curves, Figure 12, are almost identical with the threshold curves, Figure 10, of the same individual measured without a cycloplegic. Therefore, the differential leveling-off of the threshold curves of the normal and amblyopic eye seems to be due not to any optical blurredness, but to a process that may be termed physiological blurredness. The concept of index of blurredness can be utilized if one considers blurredness to be of these two types, namely optical and physiological.

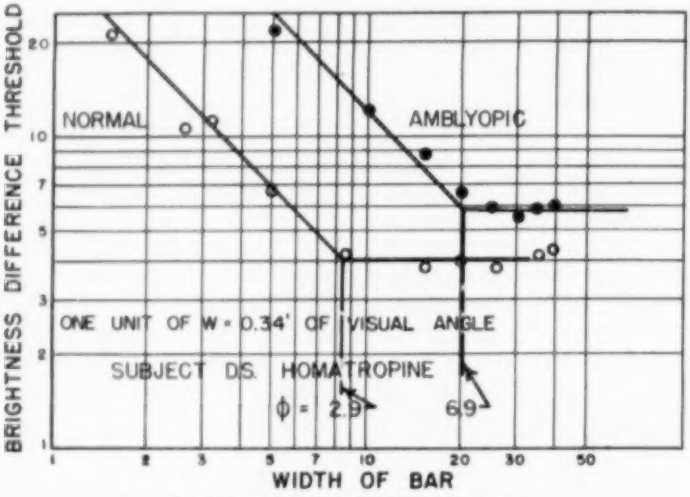


Fig. 12. Data for subject D. S. with homatropine.

The optical blurredness in theory and experiment accounts for the form of the threshold curve in the normal eye with an increased width of a narrow slit producing an increased intensity at the center of the image up to a certain value, after which the intensity remains constant. Physiological blurredness must account for the decrease in threshold of the amblyopic eye with an increase of the width of slit beyond the constant threshold level found in the normal eye and therefore, the index of blurredness ($\phi$) is greater for the defective eye.

The fact that amblyopes benefit from a larger bar width suggests that a summative process is taking place at the amblyopic fovea. The characteristic neurological connections at the fovea with the ganglion cells connected to the center of the fovea displaced toward and piled up at the rim of the fovea makes very complicated any mechanism at the

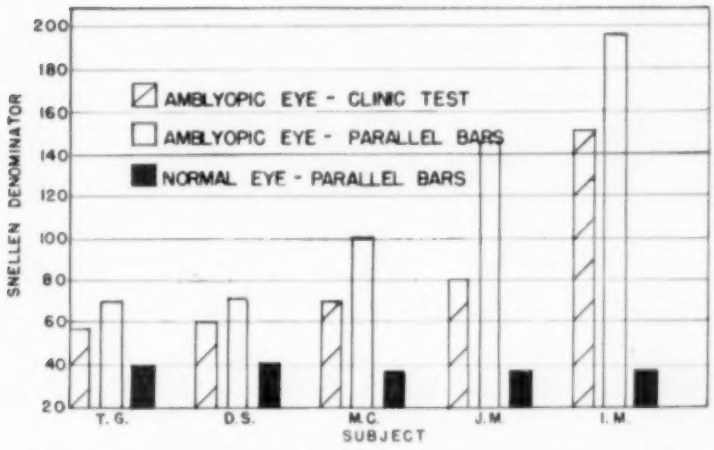


Fig. 13. Comparison of data obtained with parallel bars and clinical charts.

fovea subserving summation or interaction. It remains to be discovered whether the amblyopia involves a congenital gross derangement of retinal structure or some malfunction of structures which are normally arranged with respect to each other.

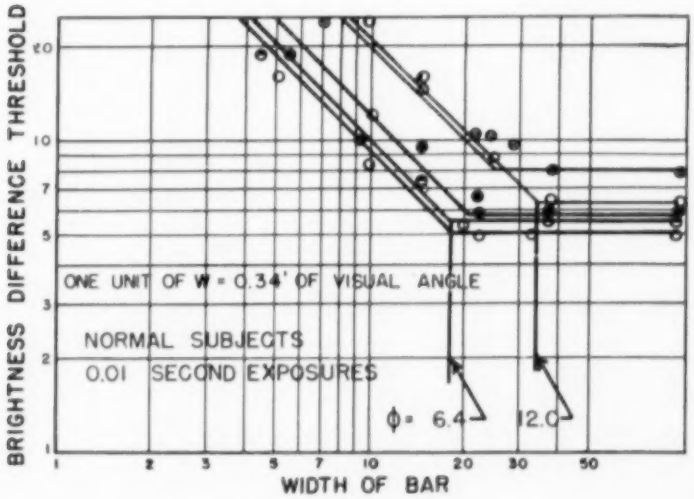


Fig. 14. Short exposure data.

In the previous paper by the author,[1] evidence was brought forth to show that the amblyope's fovea behaves like a peripheral part of a dark-adapted, normal retina indicating that summation was taking place. The possible process involved at the amblyopic fovea is revealed by the following experiment. Normal fovea of five student subjects were exposed to brief exposures (10 milliseconds every second) of the threshold stimulus. The threshold data from this experiment plotted in figure 14 shows that the indices of blurredness range from 6.4 to 12.0 minutes of visual angle. This indicates that summation, which has exactly the same overt characteristics as that present in the amblyopic fovea, occurs in the normal foveas with brief exposures. The appearance of summation with brief exposures appears to be due to the absence of opposite, yet slower, process of inhibition. Irradiation or spreading of the stimulus to adjacent neural elements is blocked or counteracted by this inhibitory process. The role played by such a mechanism in subserving simultaneous contrast has been discussed by Fry.[8]

The time characteristics of inhibition are revealed by Alpern's metacontrast studies.[9] Alpern determined the luminance of a comparison object seen by one eye required to match a test object flanked by two rectangular stimuli seen by the other eye. The test and comparison object were exposed simultaneously for a short duration but the two stimuli flanking the test stimulus were not exposed until after a period of time had elapsed following the cessation of the comparison and test stimulus. The inhibitory effect of the two lateral stimuli increased with an increase of luminance and time interval up to a maximum of about 100 sigma.

The Broca-Sulzer experiments, repeated by Alpern[7] with a binocular matching technique to avoid any depressing effect of measuring field, uncover the time characteristics of the inhibitory activity within a single small area such as that produced by the threshold stimuli in this research. There is evidence that inhibition is operating since with an increase of the duration of the stimulus the brightness increased up to a point but afterwards decreased. This can only be accounted for by a retroactive inhibition. It is possible, therefore, that spatial summation may occur with short stimuli, but if the stimulus is prolonged, a retroactive inhibition comes into play which cancels the effects of summation and irradiation. Inhibition reaches its peak after an exposure duration of 50 milliseconds. At ten milliseconds, the exposure time used to produce summation in the normal fovea in this research, inhibition is practically nonexistent. From these facts, it is theorized that the summation present in the amblyopic fovea is like the summation in the normal

fovea under conditions of brief exposure and is, similarly, due to an absence of an inhibitory process.

The next question that obviously must be answered is: does the irradiation cause the reduced acuity of amblyopia? The range of visual acuities of the amblyopic eyes measured clinically was from 20/57 to 20/150, represented by cross hatched bars in Figure 13. In order to measure the acuity more precisely and to avoid such extraneous factors as perceptibility difference and familiarity of letters, a target consisting of two black lines, separated by a white interval of equal size, was utilized. The target placed in the apparatus, was magnified until the lines were just resolvable. The results, represented by clear bars in Figure 13 show a considerably lower acuity than those determined clinically. This may be explained not only by the presence of the factors mentioned above, but also by the 3 unit target used in the research instead of the 5 unit Snellen letter employed in clinic. The reduced acuities measured by the research apparatus should be compared to the acuities of the normal eyes of the amblyopes tested by the same technique, black bars (Figure 13).

The manner in which irradiation could affect acuity is deduced from the investigation of Fry and Cobb[10] concerning normal visual discrimination of two parallel bright bars. They report that the visibility of the interval requires a minimum difference in intensity between the image of the interval and the images of the bars. These authors assumed that the optical blurring of the image of each bar produced a Gaussian distribution with a $\sigma$ equal to a certain visual angle. From this they calculated the distribution across the blurred image of two parallel bars. As the two bars approach each other the additive intensities at the center of the interval increase until the interval is obliterated and finally the bars merge into one.

It can be seen, therefore, that the smaller the $\sigma$ of the retinal image distribution becomes, the closer the bars must be brought together to remove the difference of intensity at the interval. Furthermore, $\sigma$ is directly proportional to $\phi$:

$$\sigma = \frac{1}{2.5066}\,\phi$$

Since it has been shown that amblyopes exhibit a greater index of blurredness, it necessarily follows that the two bars in the testing situation must be separated further than for the normal eye.

Figure 15 shows the index of blurredness plotted against the visual acuity measured with parallel bars, and Figure 16 shows the same thing for the clinical data. The best fitting straight line through the

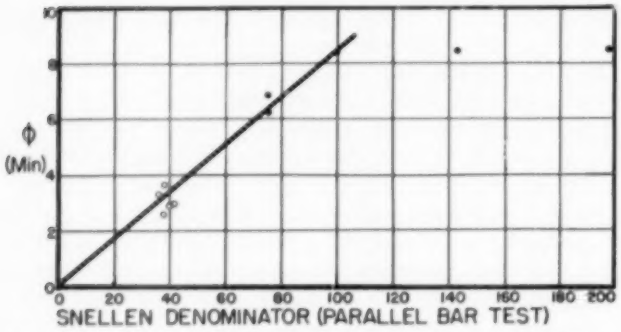


Fig. 15. Relation of parallel bar data to the index of blurredness.

origin and the plotted points for normal eyes should give the basis for predicting acuity from the index of blurredness. For subjects J. M. and I. M. the acuity measured with parallel bars deviates rather widely from that predicted by the index of blurredness. This fact has not been explained.

The amblyopes in addition to having a higher index of blurredness, exhibited a differential brightness discrimination with wide bars which differed in the two eyes of the same individual. For all subjects (Figures 6, 7, 8, 9) except one (T. C., Figure 5), the differential brightness discrimination of the amblyopic eye was less than that of the normal eye. In this respect the results obtained in this research differ from those found in the investigation by Wald and Burian.[2] These investigators used circular targets with a minimum diameter of one degree and found essentially the same differential thresholds for the amblyopic and normal eye.

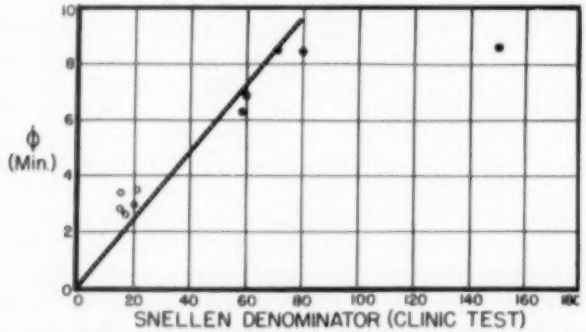


Fig. 16. Relation of clinical V. A. data to the index of blurredness.

The results of this research point to a deficiency in the peripheral part of the visual apparatus as the cause of this type of amblyopia. The loss of visual acuity, as well as the increase in the index of blurredness, is due to an absence of inhibition at the retina or at some higher level in the visual paths.

If this theory is correct, visual training given to these amblyopes would have little, if any, success in improving acuity beyond the limit set by the impaired visual apparatus. The theory is strengthened by the fact that four of the amblyopic subjects of this research had been given extensive orthoptic treatment but the visual acuity remained sub-normal. When false fixation is involved, improvement may be expected to result from training fixation so that the amblyope utilizes another part of the retina which gives better acuity.

At this point, the clinical application of these facts might be considered. By knowing the index of blurredness using foveal fixation, it might be possible to determine the maximum improvement in visual acuity that could be expected by training. The maximum possible visual acuity associated with a given index of blurredness is indicated in Figure 16. If the index of blurredness is commensurate with the manifest visual acuity, additional training would be of little value. However, if it is not, then training might be expected to improve the visual acuity to the point indicated by the index of blurredness. Nevertheless, the acuity could fail to improve as a result of such factors as minute scotomata in the foveal region.

Threshold testing in the clinical set up can be more simple than in the present investigation. Threshold measurements for only two widths are required. One, the threshold value $\triangle B_1$ of a large bar (about 60 minutes), determines the horizontal line and the second, the threshold value $\triangle B_2$ of a narrow bar of width $W_2$ (about 0.5 minutes), locates the straight line with a slope of —1 if one uses a graph like Figure 5 to determine the index of blurredness.

$\phi$ can also be determined from the following equation:

$$\phi = W_2 \frac{\triangle B_2}{\triangle B_1} .$$

## CONCLUSIONS AND SUMMARY

This research has brought forth evidence that excitation at a given point in an amblyopic fovea irradiates to the adjacent areas in a more pronounced degree than in a normal fovea. This can be demonstrated by showing that the brightness difference threshold for a narrow rectangle (slightly higher than its background) varies inversely as the

width increases for a much greater range of widths in the case of the amblyopic eye than in the normal eye. This results in an increase in the index of blurredness for the amblyopic eye.

It is proposed that the threshold is determined by the size of the summated effects at the center of the image, and the more widespread the irradiation the wider must be a rectangle before further increase in width will no longer increase the summated effect at the center of the image.

It has been found that the same type of anomaly occurs in the normal eye when short flashes are used. It is proposed, therefore, that some mechanism exists in the normal fovea which prevents irradiation or counteracts its effects. For some reason this mechanism is not effective in the case of short flashes and is defective in the case of amblyopic eyes.

An amblyopic eye also suffers a loss in ability to resolve the images of two parallel lines. This can also be explained by an increased amount of irradiation.

The index of blurredness might be used to predict the maximum extent to which acuity can be trained in an amblyopic eye. A visual acuity commensurate with the index of blurredness would not be expected to improve with training. On the other hand, training would be recommended for an amblyope possessing an index of blurredness significantly lower than the value found in this research to be commensurate with his manifest visual acuity.

A simpler method of testing thresholds than that employed in this research which would make the test more practicable clinically was proposed.

Since the completion of this study, the writer has had his attention called to a paper by Ludvigh[11] in which he reports that the "light-sense" of an amblyopic eye does show impairment if a small enough test object is used. He has also advanced the theory that amblyopia may depend upon the depressed response of on-off fibers. Normally such fibers near the border of the retinal image are kept activated by physiological nystagmus.

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## ANNOUNCEMENT

## SOUTHERN COUNCIL ON OPTOMETRIC EDUCATION FORMED

A group representing state optometric associations and state boards of examiners in optometry from nine southern states met in Atlanta, November 20-21, 1954, to consider the problems of optometric education in the South. Those present were: Dr. Evelyn Robinson, Alabama; Dr. J. G. Simpson, Arkansas; Dr. Judd Chapman, Florida; Drs. Jack Wheeler and Jack Runninger, Georgia; Dr. J. T. Christie, Kentucky; Dr. James Palmer, North Carolina; Dr. E. A. Bellune, South Carolina; Dr. S. W. Hora, Tennessee; Dr. Charles Stewart, Texas. Representatives of the Committee on Regional Programs for Optometric Education of the Association of Schools and Colleges of Optometry present at this meeting were: Drs. Walker Mathews (N. I. C. O.); James Palmer (S. C. O.); Neal Bailey (I. U.); and Charles Stewart (U. of H.).

Dr. William J. McGlothlin, consultant for Professional Programs of the Southern Regional Education Board outlined the history of the S. R. E. B. and discussed its function in connection with educational problems in medicine, dentistry, mental health, and other fields. He pointed out that education in many fields was plagued by one of the following problems: (1) The cost to the state taxpayers of maintaining a particular school is often excessive in view of the number of trained personnel required to serve the state's needs in a special field, and (2) the out-of-state fees charged to non-residents often made it impossible for worthy students to attend special schools outside of their state.

A new organization, the Southern Council on Optometric Education, was formed with Dr. Jack Runninger, Atlanta, as temporary chairman. This organization has as its most immediate objective the encouragement of a study of the educational problems of optometry in the South by the Southern Regional Education Board.

# TESTING ANISEIKONIA WITH A SIMPLIFIED SPACE EIKONOMETER*

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Aniseikonia is defined as a difference in magnification of the cortical images of the two eyes. The difference may be due to anomalies in the refractive characteristics of the eye (and correcting lenses), to the anatomic dimensions of the retinas and their neurologic connections to the brain, or to both.[1] Aniseikonia that is overall, or meridional at a vertical and horizontal axis, can be measured by the standard eikonometer—a direct comparison instrument. In order to measure meridional aniseikonia at an oblique axis, Ames designed the space eikonometer by which this anomaly is measured in terms of its effect on visual space.[2] Basing construction upon the original model, the author assembled a space eikonometer consisting of the following parts: an aperture board, the target elements, a background screen, a suitable light source, and the test lens apparatus. (Figure 1.)

The aperture board consists of ¼" thick plywood 4' horizontal x 5' vertical dimensions. The board perimeter is reinforced with kiln dried white pine boards 1" x 2" to prevent warping. It is painted a dull lusterless black on the side facing the patient. The aperture itself is a rectangle of 1' 10" horizontal and 1' 7½" vertical dimensions. The aperture is bevelled at a 45° angle to present a narrow edge to the subject. The board is suspended from the ceiling 4' in front of the patient, parallel to his frontal plane, with its center 4' 1" from the floor. The horizontal center axis will be made temporarily visible to the patient prior to testing by stretching a thin cord between two nails mounted on the back of this board. To make the cord taut when in use and easy to remove when not needed, one end is tied to one nail. The other end is weighted with a plumb bob and hung over the other nail.

A convenient method of hanging the aperture board is as follows (Figure 2): Along the top edge and six inches from each end are inserted a pair of eye screws. A pair of screw hooks 36" apart are carefully positioned in the ceiling. Two 3/32" diameter wires are prepared to hang the board. The length of the wires is dependent upon the

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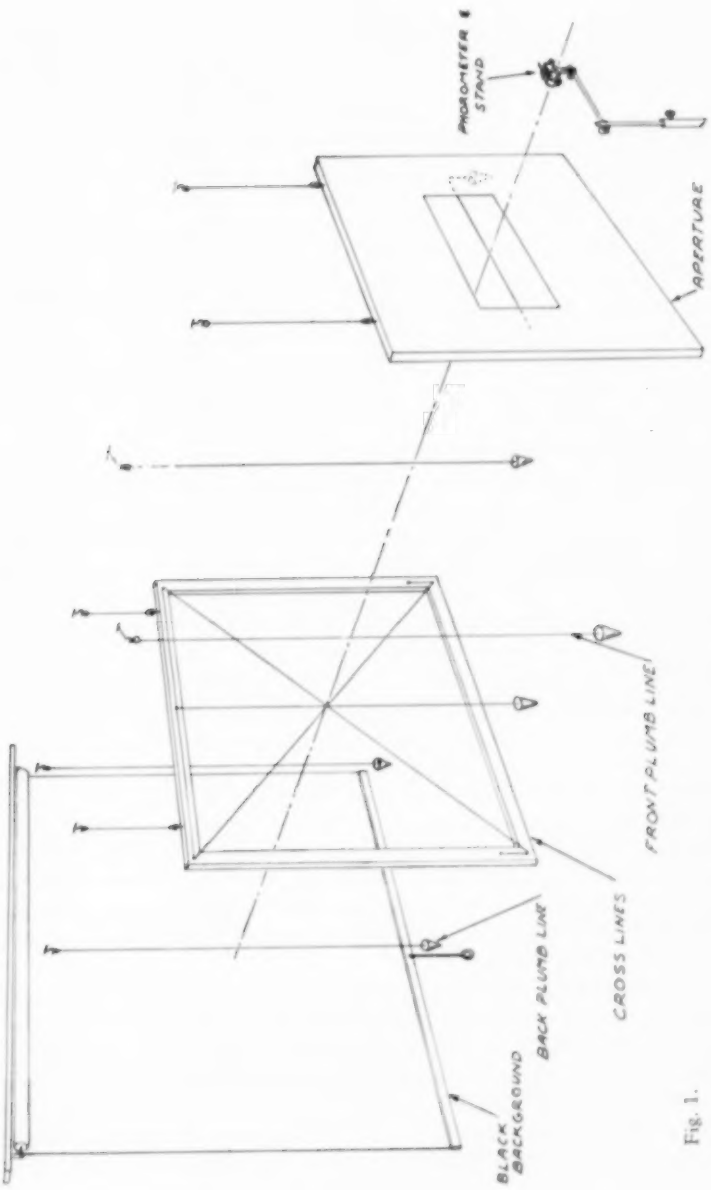
PANOMETER STAND
APERTURE
FRONT PLUMB LINE
CROSS LINES
BACK PLUMB LINE
BLACK BACKGROUND

Fig. 1.

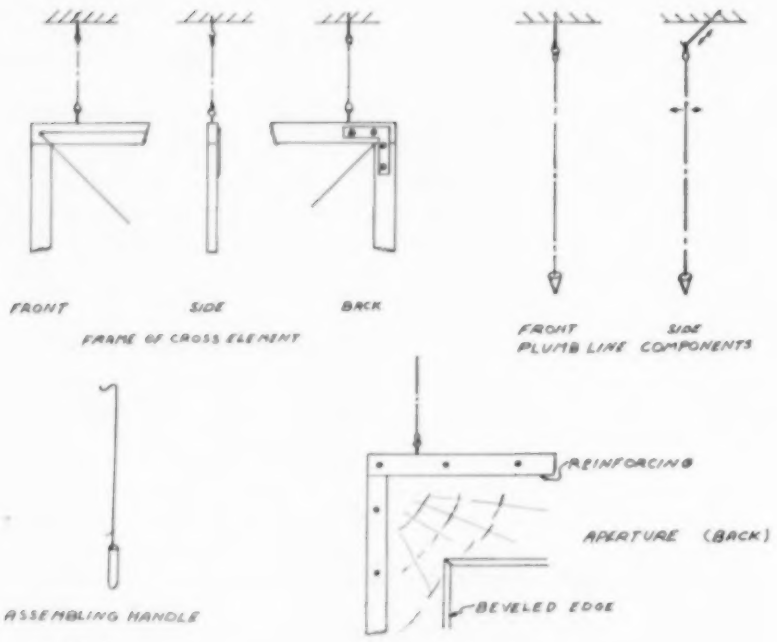


Fig. 2

height of the ceiling since the 4' 1" center height of the board is obtained by using the proper length wires. Both ends of each wire are bent into ½" diameter rings. Through the eye screws, one end of each wire is permanently but freely attached to the board and the other end is slipped over the screw hooks in the ceiling. The cross component of the target (to be described later) is also mounted by this method which permits rapid assembly and disassembly (two minutes each process) of the space eikonometer in the refracting room. Further, without measuring or truing up, accurate positioning is accomplished each time the instrument is used.

The target elements consist of: (a) A pair of fine green cords. The top of each cord is tied to a ½" double drapery ring. The ring is slipped onto a screw hook attached to the ceiling. The cords are separated by 20": equidistant from the median plane and in a plane parallel to the patient's frontal plane and 50 cm. (23.6") anterior to the next element. Plumb bobs ½" by 3¾" in length are used to stabilize the cords. The screw hooks attached to the ceiling can be inserted at

an angle in an anterior-posterior plane so that as they are mounted deeper or shallower, the cords will be moved forward or backward to match the patient-cord distance of the other cord. The pair must be positioned accurately within a 3 mm. error.

(b) A diagonal cross made by stretching red cords from a 5′ square. The square is made of suitable kiln dried lumber (1″ x 2″) with angle iron reinforced corners to maintain its square dimensions. A yellow cord attached to a plumb bob extends from the center of the top of the square in the same plane as the cross lines. The square is suspended from screw hooks in the ceiling by means of wires just as the aperture board is positioned. It is at right angles to the subject's objective median and visual horizontal planes and at a distance of 10′ from the patient. The center of the cross is 4′ 1″ from the floor.

(c) 50 cm. behind the cross, a pair of white cords is suspended in the same manner as the green cords. The color of the cords is varied so that the examiner and the patient may easily differentiate between them. The author obtained the desired colors by dying white cord.

The background screen consists of a dull black cloth tautly stretched from a wooden frame (and suspended from the ceiling) so that no seams or wrinkles are distinguishable by the patient. As an alternate method, this backdrop may be hung from a large window shade roller mounted to a 1″ x 3″ wooden plate secured to the ceiling. The minimum horizontal and vertical dimensions of the backdrop are 6′ 5″ by 6′. Its center is placed 4′ 1″ from the floor and 8″ behind the white cords. If a larger backdrop is used it may be positioned farther black. The Ames instrument backdrop was 5′ behind the back plumb lines.

A suitable light source is arranged to illuminate the cords brightly and uniformly.

The entire target is so constructed that the cords exclusively are visible. No ends and no framework can be seen. A wire with a hooked end can be used to hang and remove the white and green cords. About ten minutes are required for the plumb bobs to become immobile. The room should be free of violent air currents. A series of screw hooks placed in the ceiling along the side of the room may be used to hang the equipment out of the way when not in use.

The test lens apparatus is based on the equipment first used at Dartmouth, and was designed with the assistance of Dr. Robert Bannon and Mr. Paul Haynes of the Bureau of Visual Science of the American Optical Company. It consists of:

(a) A phorometer, modified by the removal of the maddox

rods and cross-cylinder. The gearing of the Stevens Front was changed so that the lens cells rotated toward or away from each other. Into each cell a M250% lens was mounted by the American Optical Company. The scale surrounding the lenses should be calibrated in degrees of declination error. This geared unit is used to measure the declination angle component of oblique meridional aniseikonia. A circular aperture for one side and a square aperture for the other side are mounted just posterior to the declination unit. These apertures should be arranged so that they move laterally with the lens cells to accommodate the interpupillary distance setting. The diameter of the circle and the side of the square should be 25 mm. They are positioned 50 mm. for the corneae.

(b) A series of iseikonic test lenses, both overall and meridional, of the following per cent magnification: 0.25, 0.50, 1.00, 2.00 and 2.50.

(c) A Tillyer or Orthogon trial lens set.

(d) A Tillyer trial frame #2390 or #2390A.

There are various methods of using this test lens equipment. The patient's refractive prescription, either in corrected curve spectacle lenses or in trial lenses, can be used with the phorometer. For patients who have no oblique meridional error, the trial frame can be used instead of the phorometer. Suitable small apertures are attached to the trial frame.

PROCEDURE FOR TESTING ANISEIKONIA

(1) The accurate subjective prescription is placed in the phorometer according to the method recommended by the designers of the original space eikonometer.[3] The patient's head is adjusted comfortably and correctly aligned. Then the cord is strung across the center of the back of the aperture board. The patient is raised or lowered in the refracting chair until he reports that this cord appears to be projected through the center of the diagonal cross. Then the cord is removed. Variations from orthostereopsis are demonstrated as follows:

(2) An M150% at axis 90 is placed in the right side of the phorometer. If the patient has no aniseikonia, the left green line, the left white line and the left side of the cross will appear closer. The power of the lens may need to be increased to M200% or M250% to elicit the response. The expected reaction can be demonstrated by the examiner by walking into the target area and then pointing out the probable appearance.

(3) An 0150% lens is then placed in the right side of the phorometer. The left green and left white lines will appear closer than the right green and white lines.

(4) The geared meridional lenses or declination angle measuring unit are now rotated in a positive direction, *i.e.* with tops inclined toward each other. The patient is asked to observe that the top of the cross is inclined closer to him, the bottom away. The yellow vertical line should remain essentially vertical.

Now we proceed to the principal test which can be accomplished according to two somewhat different methods, viz.: (1) the method developed by the Dartmouth group, and (2) a variation of this technique as described by Fisher in "A Modification of Space Eikonometer Technique."

First the standard technique:[2] With the subjective correction in the phorometer, the patient is asked to describe the target. If one green line is closer than the other, then that same side is magnified with meridional lenses axis 90° placed in front of the correction lenses in increasing amounts . . . M50, M100, M150, etc., until the situation is reversed. One-half of the limit of change in magnification within which the patient reports the lines equidistant is recorded; as, ±.25% or ±.50%, etc. It is a measure of the patient's sensitivity. The midpoint between these limits is the patient's axis 90° correction.

If the patient reports that one side (top and bottom) of the cross is closer, the image of the other eye is magnified with meridional lenses axis 180°; the same bracketing, or method of limits, is employed. The declination angle measurement follows. If the top of the cross appears tilted toward the patient, the declination unit is moved in a minus direction (tops of M250% lenses move away from each other); again the error is bracketed. The findings are refined by repeating the three measurements beginning with the lenses found above. These components are converted to the equivalent iseikonic correction by referring to "Magnification Tables for Use With the Space Eikonometer" (American Optical Company).

The iseikonic correction as derived from the tables may be inserted in the trial frame, anterior to the refractive prescription on which it is based, and the patient can then report the effect of the correction.

Before discussing the modification of the above technique, it is appropriate to diverge from testing methods to a brief discussion of the intriguing phenomenon of "Induced effect."[4] A disparity of the retinal images of the two eyes in the horizontal meridian gives rise to a stereoscopic response. It can easily be demonstrated in a stereoscope with simple targets or it can be produced by a meridional lens axis 90° before either eye. Even a plus or minus cylinder axis 90° before one eye will produce a definite change in perception of depth. The distortion produced by M100% axis 90° can be measured in a horoptor

device and this effect will agree with the geometric calculations of the modification of the horopter. However, a meridional lens held axis 180° before one eye would be expected to have no effect on stereoscopic vision since vertical disparities are not expected to produce stereoscopic phenomena. Nevertheless, a meridional lens M100% or M200% axis 180° in front of one eye—having a magnifying effect exclusively in the vertical meridian—will produce an "induced effect" of apparent magnification of the other eye's image but in the horizontal meridian. An overall magnifying lens can be visualized as two equal meridional lenses at right angles to each other much as a spherical lens can be composed optically of two equal power cylinders. Therefore, under ordinary environmental conditions, the deviation from orthostereopsis produced by an overall lens impinges upon our consciousness slowly if at all, since the vertical and horizontal magnifying effects are somewhat equal and opposite—tending to neutralize each other. The induced effect increases proportionately with the power of the meridional lens held axis 180° up to a certain power—varying with the individual and of course the testing instrument (horoptor devices, null method, tilting plane apparatus, etc.). Past this power from about 5% to 9% the induced effect reverses itself and diminishes with further increase in magnification.

It is because of this phenomenon that care must be taken to avoid binocular clues such as irregular or frayed cords or spots on the background screen. Also the inner edges of the aperture board should not be clearly visible to both eyes of the subject. This special occlusion is produced by the round and square shaped openings next to the declination unit.

An overall error elicits a particular variation of the space eikonometer target. It causes a heterolateral advance of the vertical lines. This is correctable with an overall correcting lens, or in the manufactured space eikonometer with meridional lenses equal in power at axes 90° and 180° in front of the same eye. The test parameters in the space eikonometer—meridional lens axis 90°, meridional lens axis 180° and declination correction—are somewhat obscure relative to aniseikonia in terms of its correction by an overall lens and/or a meridional lens, frequently at an oblique axis.[5] Since there may be little apparent relation between the space eikonometer findings and the refractive error, some odd or unreasonable size corrections may be indicated by the space eikonometer which will not be verified later in a test frame. Therefore based on both qualitative explanation and a mathematical proof, Fisher proposes:

"(1) That the horizontal component of the difference in size of the ocular images be determined by overall magnifying lenses using the same criterion as in the Ames-Ogle technique.

"(2) The remaining difference in size of the ocular images in the vertical meridian, which is the meridional component, be determined by means of meridional lenses at axis 180°. . . .

"(3) That the binocular declination error be determined as in the Ogle technique.

"(4) That the test parameters be converted to the parameters of the oblique meridional aniseikonic correction. . . ." by means of a table accompanying Fisher's article.

The author uses this second method in testing. Following either the standard or the modified testing procedure, the iseikonic correction determined by reference to the tables are placed in the trial frame anterior to the subjective lenses. Then the patient observes the space eikonometer, the visual acuity chart, the surrounding walls and the outdoor environment. Existing imperfections in the iseikonic prescription may be found and corrected. In order to be filled by the American Optical Company laboratory in Southbridge, the final prescription must be written as directed.[3]

Certain basic principles concerning the relationship of the refractive and iseikonic test lenses should be reviewed. The spherical lenses of the trial set have equal center thicknesses and are on the same front curve. Therefore when used properly (correct distance and balanced binocularly) and when only a spherical error exists, then the overall or meridional iseikonic test lenses are a good indication of the actual size correction needed in the final lens. However, when astigmatic errors exist, especially at oblique axes, then the cylindrical trial lenses may introduce an aniseikonic error which is in excess of the standard spectacle lens aniseikonic error. This is true even though the cylindrical trial lenses also have equal center thicknesses and the same base curve. In order to avoid this extraneous size factor known as "cylindrical excess magnification"[6] it is often advantageous to measure the aniseikonic error based upon the spectacle correction rather than the trial lens correction.

Using the phorometer with the declination unit and the space eikonometer target described requires a room at least fourteen feet long. Using individual iseikonic test lenses is a slow and somewhat cumbersome process. However the examiner can easily identify to the patient the variations from orthostereopsis. Once the instrument is adjusted, the optical unit containing both the refractive correction and the iseikonic

elements is fixed relative to the target. Therefore only the patient's head movements from the phorometer need be prevented. In the commercially available eikonometer, the test frame is a third component to be carefully adjusted and immobilized (head, trial frame, and space eikonometer). The American Optical Company space eikonometer permits much greater facility in obtaining an infinite variety of iseikonic combinations—of course a most desirable feature.

Iseikonic prescriptions are filled by the American Optical Company at Southbridge and in many cases no other laboratory can fabricate this type of correction, even if they (or the examiner) can calculate the correction. To illustrate: frequently a bitoric correction is used. This necessitates permabonding a minus cylinder component (single vision or bifocal) with a single vision plus cylinder lens to effect the proper refractive and iseikonic combination. If the lenses are twisted relative to each other by a fraction of a degree, the resultant error in the refractive correction would be unacceptable. Certain weak overall prescriptions are easier to make, cost less to compound, and can be approximately calculated by following the formulae suggested by Rosett.[7] Occasionally time can be saved in securing these simple corrections locally. A complete analysis of the lens design should be studied so that the nature of the actual size error and the complicated optical factors in the testing procedure are understood.[6, 8]

"There has been a demand for some sort of screening test for aniseikonia and while various ideas and gadgets have been suggested there is not yet available an instrument that may be considered an adequate screening test for this purpose. A few practitioners have made their own models of the space eikonometers but these instruments are more than screening tests. They are actually measuring devices from which prescriptions are written."[9] Perhaps those instruments that might be considered as the most likely to succeed in screening for aniseikonia were made by the Dartmouth group and then were superseded by the space eikonometer. Horoptor measuring devices first were used to measure the effects of aniseikonia but only in the horizontal meridian and hence were considered inadequate.

A series of "tilting boards"[10] were used to determine the nature of spatial distortion resulting from aniseikonia. Although some of these permitted quantitative analysis, they were mostly useful as a qualitative guide in the research. Devices of this type have little clinical value at this time. However, they served to prove that when monocular clues to depth perception are removed or reduced, uncorrected aniseikonia invariably distorts the visual environment. The appearance of the "leaf-

room" will be distorted by aniseikonia and thus it might be used to screen for aniseikonia. However, little or no distortion appears from an over-all image size difference due to the induced effect. Also, it is usually difficult to separate the distortion due to an image size difference in the horizontal meridian of one eye and one due to a difference in the vertical meridian of the other eye.[11]

The Turville test slide has been used for the screening of aniseikonia. Also, Elvin devised a method for measuring aniseikonia which enabled him to correct a patient with an overall aniseikonia.[12]

Symptoms are a major consideration in the detection of aniseikonia. They are classified essentially in order of frequency:[13]

"I. Asthenopic symptoms
- Ocular discomfort (burning, itching, etc.)
- Ocular fatigue in close work and while watching moving objects (at movies, in driving, while watching games)
- Headaches of various types
- Photophobia
- General nervous fatigue or nervous tension, sleepiness, gastric symptoms, car and train sickness

"II. Impaired fusion and/or poor stereopsis

"III. Anomalous spatial localization."

These same symptoms can exist as the result of any uncorrected ocular abnormality but the persistance of the symptoms after correction of the abnormality would indicate the possibility of aniseikonia.

At this time, 63 patients have been tested by the writer, 28 or 44% of whom were given iseikonic corrections. Of these, 20 were definitely benefited. Two found some slight help and therefore use the correction. Five were unsuccessful and one remains unreported. Ten patients (36% of those receiving correction) were given overall corrections. In THE ANISEIKONIC FORUM BULLETIN NO. 19,[14] 53 clinicians indicated that 36% of their patients received overall size lenses. Of the author's patients, 14% received meridional lenses axis 90° or 180°. However 46% of the patients reported in the BULLETIN received this type of meridional correction. Finally, 50% of the author's patients who received iseikonic lenses were corrected by oblique meridional magnification lenses compared to 18% of the patients by the reporting group in the BULLETIN.

Two factors might be considered in these comparisons. First, 28 cases are not enough for significant analysis in this complicated work. Second, an undetermined number of the 53 clinicians reporting measured their patients on the standard eikonometer wherein no measurement of

an oblique meridional error is possible.

SUMMARY

Ames' original space eikonometer consisted of an aperture board, target elements, background screen, suitable light source, and test lens apparatus. Each component with the author's mechanical design for some of the elements is described.

The author tested 63 patients of whom 28 were given iseikonic lenses. Of these 28, 20 were definitely benefited, two found some slight help and use the correction, five were unsuccessful, and one remains unreported.

The author wishes to thank Dr. Kenneth N. Ogle, Mayo Clinic, and Dr. Robert Bannon, Bureau of Visual Science, American Optical Company, who read this article and offered many suggestions and improvements.

1350 GARNET AVENUE,

SAN DIEGO, CALIFORNIA.

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# OBSERVATIONS ON CONTACT LENS PRACTICE*

J. Erlanger†
Edmonton, Alberta, Canada

No attempt is being made in this paper to suggest new discoveries or theories in the contact lens field. It is rather a review of certain features of contact lens practice with emphasis on experiences in my own practice. Although greatly interested in them, I have refrained from discussing the newest arrival in the field, the microlens. Some minor experience with them has helped to strengthen the belief in their future application which has been aroused by Dr. Neill's contributions. However, I believe that most of the opinions, experiences and conclusions discussed will also apply to microlens fitting—for that matter—to the fitting of any type of contact lens.

This raises the question: What actually makes for success in a contact lens case? Off-hand one would, of course, put "a good fit" as the prime requisite for a satisfactory pair of lenses. Based on my own experience I would consider "need" or "motivation" an equally—if not more—important factor in the successful acceptance of contact lenses. The young woman patient who would like to get contact lenses "just because she does not like glasses" will co-operate with enthusiasm during the fitting process and will perhaps even make an effort to develop tolerance for the lenses. However, after the novelty has worn off, she will gradually make her attempts at wearing them at greater intervals and will eventually come to the conclusion that somehow she cannot get used to them or rather that she cannot be bothered with them; even though the lenses are technically a good fit. On the other hand a person with a distorted cornea may wear a pair of contact lenses persistently although the fit could be improved upon. The following experience will illustrate this point.

The patient, a young girl, had been referred by a fellow optometrist when she was 14 and still at school. Incipient keratoconus was found to be present as the major problem. Nothing was done at the time, as vision was still fair and, in spite of an explanation, the patient took the matter very lightly. However, several years later the patient returned, this time very depressed. She was then a student nurse. In the intervening years her conical corneae had become more pronounced. All

*Read before the annual meeting of the American Academy of Optometry, Contact Lens Section, Toronto, Ontario, Canada, December 12, 1954. For publication in the January, 1955, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.
†Optometrist, Fellow, American Academy of Optometry.

attempts at improving her detiorating vision with glasses had failed. She had given up sports and other activities which required good vision and she was on the point of being forced to give up her nurses training when she called to have me prescribe contact lenses.

A moulding was done and fluid type lenses were fitted. These gave her practically normal vision and her reaction was good. Although the patient was requested to report to the office for further adjustments the writer did not see her again for some considerable time. At this next visit one of her eyes was badly injected. This was caused by an apex touch and I asked her why she had not reported this to me. After some hesitation she exclaimed: "I was afraid that you might take the contact lenses away from me." The patient was, of course, persuaded to let us have the offending lens and it was returned to her after the necessary deepening of the inside curve. This patient is wearing her contact lenses during all her waking hours. Several years later the lens again touched the cornea.

The recurrence of the apical touch in this and similar cases seems to bear out a contention voiced by Wesley in his book that in the fluid type lens the cornea will tend to conform to the inside surface of the contact lens. In other words, the use of a fluid type lens will encourage progression of the deformity.

Patients with corneal irregularities such as keratoconus, scars and irregular astigmia are the best users of contact lenses, in the writer's judgment. Contact lenses also fill an important need in very high refractive errors and cases of unilateral aphakia, especially if the patient's occupation makes the wearing of glasses hazardous or impractical. As the need gets less so does the percentage of successes reduce.

Through the years the writer has found that a trial contact lens of any kind—however well fitting physically—never "feels" right if the vision with them is poor. It is only after the proper refractive correction has been supplied in a trial frame that the patient's reaction to the lenses can be judged. When a prolonged trial of contact lenses which require considerable optical correction is desirable, spherical lenses of the required power should be supplied in a spectacle frame in order to permit the patient to wear the contact lenses under most favorable conditions. The writer feels that this feature of contact lens fitting is generally not considered of sufficient importance and should be stressed.

It is not the intent of this report to discuss at length the necessary equipment of the contact lens practitioner. There is only one feature which the writer would like to comment upon. Reference is made in text books and instruction manuals to the keratometer method *as com-*

*pared* to the trial case method of fitting corneal contact lenses. In the light of experience the writer would suggest that both pieces of equipment are *musts* for the contact lens practitioner. While keratometer measurements have in most cases been found to be reliable guides in the selection of lenses of proper inside curves; most surprising experiences have shown that this is not always so, especially in cases of high corneal curvatures.

This brings to mind the extremely divergent views held about the use of corneal contact lenses in highly astigmatic corneae. Norman Bier, in his book *Contact Lens Routine and Practice* advises against corneal contact lenses in these cases. This is what he says, page 125: "Corneal lenses are inadvisable for high toroidal and irregular eyes including those with keratoconus." On page 140 in discussing the same subject and speaking in terms of differences between the two major corneal meridians he says: "Cases with 1.00D. difference and over are frequently unsuccessful and should be reviewed with suspicion. When over 1.50D. to 2.00D., corneal lenses should never be prescribed."

Opposite views are held by Drs. Wesley and Jessen who advise that in keratoconus cases none but corneal lenses should be prescribed. The writer's experience seems to prove that Bier's position is somewhat over-conservative. However, the writer considers Bier's book an outstanding and authoritative work.

There are some additional features of contact lens fitting which I think are interesting enough to mention. One is the consideration of anatomical pecularities in estimating the chances of success at the first visit of a contact lens patient. The writer would have no hesitation in attempting to fit a football player with corneal contact lenses to be worn on the grid-iron if he has deep set eyes and narrow palbebral fissures. On the other hand, I would approach with trepidation the task of fitting a young woman with exophthalmic eyes who wished corneal contact lenses. This last comment may not apply to microlenses.

Another observation is that the first reaction of the patient to corneal lenses is sometimes deceiving. The patient who exhibits all the signs of easy adaptability when trial lenses are inserted the first time does not always turn out to be a successful case. It is, on the other hand, not uncommon to find that the patient who exhibits a violent reaction at the first insertion such as copious lacrimation, injection, blepharospasm, etc., often develops a high degree of tolerance with long wearing periods. In this connection it may not be amiss to mention the well known fact that tight lenses usually feel comfortable at insertion while adverse symptoms will appear before long. An exclamation

to the effect that "these lenses are fine, I cannot feel them at all" should be considered a warning and cause a careful inspection to ascertain whether the lenses are not of too short a radius.

One more observation which I think worth emphasizing is the importance of dexterity in inserting lenses. All other factors being equal, a lens inserted smoothly and quickly will be worn for a longer period than one inserted only after a couple of fumbles.

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## ANNOUNCEMENT

### CLEVELAND FORUM ON VISUAL PROBLEMS IN SCHOOLS

The eighth annual Forum on Visual Problems in Schools will be held February 25-27, 1955, at the Hotel Statler, Cleveland. The speakers will be, H. Ward Ewalt, O.D., Pittsburgh; Howard F. Haines, M.Sc., D.O.S., Columbus; V. J. Ellerbrock, Ph.D., Columbus; Evelyn Eisnaugle, State Department of Education for Ohio; T. R. Murroughs, O.D., Evanston; Roma Gans, Ph.D., New York City; Alfred Rosenbloom, O.D., Chicago; Glenn O. Blough, Ph.D., Baltimore; Wilmot F. Schneider, M.D., Cleveland; Newell C. Kephart, Ph.D., Lafayette, Indiana; Nancy Wood, Ph.D., Cleveland, and Mary C. Austin, Ph.D., Cleveland. In addition to the talks and discussion sessions there will be a number of clinical demonstration periods. Dr. Lois B. Bing, Cleveland, is in charge of the program, which is being put on jointly by the American Optometric Association and the Northeastern Ohio Chapter of the American Academy of Optometry. The registration fee for the three day meeting, including banquet ticket, is $17.50. All optometrists are invited. Advance registration may be made by writing Dr. V. Tootikian, 12415 St. Clair Ave., Cleveland 8, Ohio.

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## ACADEMY REGRETS UNJUSTIFIED ATTACK

It has been called to the attention of the Executive Council of the American Academy of Optometry that an unsigned editorial *No Friend of Optometry* appearing in the SOUTHERN OPTOMETRIST,* presents what appears to be an unfair attack upon an Honorary Life Member of the Academy, Dr. William Benedict, of Rochester, Minnesota. It is the further agreement of the Council that this statement be presented to refute and answer the editorial under consideration.

Dr. William Benedict is an ophthalmologist with an international reputation as a specialist in his field. He is Secretary of the American Academy of Ophthalmology and Otolaryngology and Editor of the TRANSACTIONS OF THE AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY. He has served with distinction in many fields, and is widely honored as both a physician and humanitarian. At no time in his long career has there been the slightest evidence of his deal-

*November, 1954, issue, pages 29-30.

ing with his fellowmen in any way but one of integrity and fairness.

During his distinguished lifetime he has had—on many occasions—the opportunity to study the programs of optometrists and consult with optometrists. On each of these occasions his attitudes and judgments have been honest and fair in the opinion of those optometrists with whom he has dealt. That he has not always agreed with proposals of optometrists is admitted—but in such conferences he has always distinguished himself by his honesty and openmindedness and by his integrity. We always knew just where he stood on the issues of the moment.

The editorial in the SOUTHERN OPTOMETRIST criticizes an article written for lay readers by Dr. Benedict which appeared as one of a series of health articles sponsored by the American Medical Association in THIS WEEK.† The editorial not only disagrees with Dr. Benedict's conclusions on eye hygiene, but also infers that the article *Save Your Eyes* is an attack upon optometry. The Executive Council of the Academy finds that this is not the case. A review of Dr. Benedict's article shows that there was no attack upon optometry. Accepted optometric education does not recognize eye exercises, palming or "forcing" the eyes to see, as a cure for myopia. The Executive Council of the Academy finds that the article in question is unbiased and fair, and that it is informative to lay readers and further feels that it will serve the purpose for which it was written—that of conserving vision.

The Executive Council of the American Academy of Optometry wishes to go on record as disapproving the unsigned editorial *No Friend of Optometry* in the SOUTHERN OPTOMETRIST and expresses to Dr. Benedict and to all ophthalmologists our apologies and regrets that such an attack could have appeared in a publication professing to serve optometry.

THE EXECUTIVE COUNCIL‡

†W. L. Benedict. Save Your Eyes. This Week. October 24, 1954.

‡The members of the Executive Council of the American Academy of Optometry are listed on page 47 of this issue.

## TRANSACTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY

A department devoted to announcements, reports, appointments, organization data, news, professional problems and ideals, as these relate to the Academy.

### TORONTO MEETING AN OUTSTANDING SUCCESS

The setting was the Royal York Hotel in Toronto, Ontario, Canada, the biggest and finest hotel in the British Empire. The dates

were December 11-14, 1954, and the occasion was the 34th Annual Meeting of the Academy. More than 200 members and guests were present. This Academy meeting was the first held outside of the States, and our Canadian members lived up to their reputations for graciousness and hospitality.

PERRY ELECTED PRESIDENT

Dr. John D. Perry, Jr., Winston-Salem, North Carolina, was elected to succeed Dr. Meredith W. Morgan, Jr., as president. Dr. Perry is in practice in his home city, and also serves as a member of the board of trustees of the Pennsylvania State College of Optometry. During the past two years, he has been vice-president of the Academy, and also chairman of its Papers and Program Committee. Dr. Perry is married and has one daughter. His wife and daughter attended the meeting and enjoyed seeing him unanimously elected to the top Academy post. A picture of Dr. Perry appears as the frontispiece in this issue of the Journal.

OFFICERS AND EXECUTIVE COUNCIL

In addition to Dr. Perry, the other newly elected officers and members of the Executive Council of the Academy are: Dr. Robert W. Tubesing, Richmond, Indiana, vice-president; Dr. Carel C. Koch, Minneapolis, secretary-treasurer; Dr. Meredith W. Morgan, Jr., Berkeley, immediate past-president; Dr. Lawrence Fitch, Philadelphia, chairman, Committee on Chapters and Charters; Dr. Donald A. Springer, Anniston, Alabama; Dr. Ralph E. Wick, Rapid City, South Dakota; Dr. J. Donald Kratz, Souderton, Pennsylvania, chairman, Papers and Program Committee; Dr. Harold Simmerman, Wenonah, New Jersey, chairman of the Committee on Admittance, and Dr. Kenneth B. Stoddard, Berkeley, chairman of the Editorial Council.

SCIENTIFIC AND CLINICAL PROGRAMS

It was the concensus of those present that the general scientific sessions and the clinical meetings of the five Sections were the finest ever presented at an annual meeting. The more than 50 speakers presented an excellent blend of theory, research and clinical practice. These speakers made the full four day session an educational event long to be remembered.

The speakers at the general scientific sessions were:

Max Schapero, O.D., Frank W. Weymouth, Ph.D., Gordon G. Heath, O.D., M. Sc., Merrill J. Allen, B.Sc., Ph.D., Robert E. Bannon, O.D., B.Sc., J. I. Pascal, M.A., O.D., M.D., William G. Walton, Jr., O.D., Gerald Westheimer, Ph.D., Glenn A. Fry, Ph.D., Merton C. Flom, O.D., B.Sc., Eugene Freeman, Ph.D., John C. Neill, O.D., Ingeborg Schmidt, M.D., Monroe J. Hirsch, Ph.D., Lawrence Fitch, O.D., John Zettel, Jr., O.D., H. Ward Ewalt, O.D., Francis A. Young, Ph.D., William P. Schumann, O.D., J. M. Enoch, O.D., Meredith W. Morgan, Jr., Ph.D., Henry W.

Hofstetter, Ph.D., Darrell B. Carter, M.Sc., O.D., Fred W. Sinn, O.D., G. Maurice Belanger, O.D., Sylvester K. Guth, B.Sc., E.E., D.O.S., A. A. Eastman, B.Sc., E.E., Irving Vics, O.D., R. A. Sherman, D.O.S., Howard Haynes, B.Sc., E.E., Fred W. Jobe, Ira Schwartz, B.A., O.D., Milton S. Katz, M.A., Melvin C. Nadell, O.D., Ph.D.

A detailed review of this portion of the program along with the titles of the papers which were given at Toronto, appeared in the November, 1954, issue. Many of these papers and those presented at the Section meetings will appear in this Journal in 1955.

To a very great degree the clinical side of optometric practice is stressed at the five Section meetings. The programs as followed by the Sections at Toronto are presented here for the first time.

ANISEIKONIC SECTION

Sunday, December 12, 1954, 9:00 A.M.—11:00 A.M.

Practical Approach to Iseikonic Lens Design. Edwin W. Bechtold, Ph.D., Columbia University, Department of Optometry, New York City.

The Role of Aniseikonia in Optometric Practice. Harold M. Fisher, O.D., New York City.

General open discussion.

Monday, December 13, 1954, 9:00 A.M.—11:00 A.M.

Screening Tests for Aniseikonia. V. J. Ellerbrock, Ph.D., Ohio State University, School of Optometry, Columbus; Benton Freeman, O.D., Allentown, Penna.; Samuel Swartz, O.D., Plymouth, Mass., and Rudolph T. Textor, O.D., Elizabeth, N. J.

Incidence of Aniseikonia and Repeatability of Measurements. Alfred A. Rosenbloom, O.D., Northern Illinois College of Optometry, Chicago.

Tuesday, December 14, 1954, 9:00 A.M.—11:00 A.M.

Round Table Discussion of Case Reports. Paul L. Connolly, O.D., Detroit; J. C. Kehoe, O.D., Flint; Bernard Mazow, O.D., Houston; William Policoff, O.D., Wilkes-Barre; Oscar L. McCulloch, O.D., Holyoke; William Schumann, O.D., Vineland, N. J., and Donald A. Springer, O.D., Anniston, Alabama.

Professional and Public Relations Developments in Aniseikonia. Robert E. Bannon, O.D., M.S., Southbridge, Mass.

Dr. Robert E. Bannon served as chairman of the Section and presided at the sessions.

CONTACT LENS SECTION

Sunday, December 12, 1954, 9:00 A.M.—11:00 A.M.

Communication. Norman Bier, O.D., London, England.

Communication. Robert J. Fletcher, O.D., Northampton Polytechnic Institute, London, England.

Random Reflections on Contact Lens Practice. Julius Erlanger, O.D., Edmonton, Alberta, Canada.

Clinical Report on the Use of Corneal Lenses for the Correction of Unilateral Aphakia with Specific Reference to Binocular Function. Alfred A. Rosenbloom, O.D., Northern Illinois College of Optometry, Chicago.

Monday, December 13, 1954, 9:00 A.M.—11:00 A.M.

Some aspects of Micro-Lens Fitting. E. J. Fisher, O.D., M.S., Dean, College of Optometry of Ontario, Toronto.

Role of Contact Lenses in Myopia Control. Joseph F. Nupuf, O.D., Canton, Ohio.

A Contact Lens-Telescopic Lens Fitting Combined With a Multiple Lens Monocular Loupe for Near Point Use by a Sub-Normal Vision Patient—A Case Report. Alfred A. Rosenbloom, Northern Illinois College of Optometry, O.D., Chicago.

Tuesday, December 14, 1954, 9:00 A.M.—11:00 A.M.

Methods Used and the Results Obtained by Techniques Recommended by Norman Bier. D. O. Elliot, Jr., O.D., South Bend, Indiana.

A Case of Artificial Iris. Nathan Robbins, O.D., Buffalo.

The Use of a Multiple-Curved Corneal Lens for Medium and Severe Cases of

Keratoconus. Alfred A. Rosenbloom, O.D., Northern Illinois College of Optometry, Chicago.

Legal Status of Contact Lens Fitting in the State of Delaware. Harold I. Moss, O.D., Wilmington.

Dr. Isidore S. Finkelstein served as chairman of the Section and presided at the sessions.

## SECTION ON OCCUPATIONAL OPTOMETRY

Sunday, December 12, 1954, 9:00 A.M.—11:00 A.M.

Report on Section. Richard Feinberg, Ph.D., president, Northern Illinois College of Optometry, Chicago.

Some Ways that Optometry Can Help the Industrial Worker. Miss Jane Davis, Department of Ophthalmic Research, Bausch and Lomb Optical Company, Rochester.

Research in Industrial Seeing Problems. Robert E. Bannon, O.D., M.S., Bureau of Visual Science, American Optical Company, Southbridge, and Sylvester Guth, M.E., D.O.S., General Electric Company, Nela Park, Cleveland.

Monday, December 13, 1954, 9:00 A.M.—11:00 A.M.

An Inventory of Optometric Services in Industry. Glenn A. Fry, Ph.D., Director, School of Optometry, The Ohio State University, Columbus; W. J. Heather, O.D., American Optical Company, Southbridge, Mass.; H. Sager, O.D., Sperry Gyroscope Company, Lake Success, N. Y.; R. A. Sherman, D.O.S., Bausch and Lomb Optical Company, Rochester, and J. R. Wittekind, O.D., Morrisville, Penna.

Tuesday, December 14, 1954, 9:00 A.M.—11:00 A.M.

An Educational Syllabus in Occupational Optometry. E. L. Steinberg, O.D., New York City.

Summary of the Proceedings. Richard Feinberg, Ph.D., president, Northern Illinois College of Optometry, Chicago.

Dr. Richard Feinberg served as chairman of the Section and presided at the sessions.

## ORTHOPTICS SECTION

Sunday, December 12, 1954, 9:00 A.M.—11:00 A.M.

Assisting the Amblyopic Child. Howard F. Haines, M.Sc., D.O.S., and Mrs. Howard F. Haines, A.B., M.E., Columbus.

Visual Training Decisions at the Consultation and Refracting Chair. Neal J. Bailey, O.D., Indiana University, Division of Optometry, Bloomington, Ind., and John Zettel, O.D., Cincinnati.

Monday, December 13, 1954, 9:00 A.M.—11:00 A.M.

Orthoptic Procedures in Exotropia. (Minus Lens Technique). John R. Kennedy, O.D., St. Paul.

A Clarifying Note on Normal and Anomalous Correspondence. Joseph I. Pascal, M.A., O.D., M.D., Attending Ophthalmologist, Lecturer in Ophthalmology, New York Polyclinic Medical School and Hospital, New York City.

Speakers introduction to tomorrow's topics. (See Tuesday) by Drs. Flom and Rosenbloom.

Tuesday, December 14, 1954, 9:00 A.M.—11:00 A.M.

The University of California Strabismus and Orthoptics Study. A Preliminary Report. Merton C. Flom, M.Sc., Clinical Instructor in Optometry, University of California, School of Optometry, Berkeley.

Diagnostic Test in Office Practice to Discover the Retarded Reader. Alfred A. Rosenbloom, O.D., Northern Illinois College of Optometry, Chicago.

Dr. Paul L. Connolly served as chairman of the Section and presided at the sessions.

## PATHOLOGY SECTION

Sunday, December 12, 1954, 9:00 A.M.—11:00 A.M.

Glaucoma, Part I—Statement of the Overall Problem. Monroe J. Hirsch, O.D., Ph.D., Ojai, Calif.

The Plotting of Glaucoma Fields—A Demonstration. Harold Simmerman, O.D., Pennsylvania State College of Optometry, Philadelphia.

The Taking of Intraocular Tension—Scleral Method—A Demonstration. Ralph Wick, O.D., Rapid City, S. Dak.

The Taking of Intraocular Tension—Corneal Method—A Demonstration. Harold Simmerman, O.D., Pennsylvania State College of Optometry, Philadelphia.

Monday, December 13, 1954. 9:00 A.M.—11:00 A.M.

Glaucoma, Part II—Panel. The Optometric Procedure After the Diagnosis of Glaucoma has been made—Statement of the Problem. Monroe J. Hirsch, O.D., Ph.D., Ojai, Calif.

National Committee on Eye Care Suggestions for Referral of Patients. Carel C. Koch, O.D., Minneapolis.

Experiences and Practical Hints from Panel Members. Drs. Wick, Simmerman and Hirsch.

Convergence Paralysis—Three Case Reports. Arthur Bruce, M.D. Paper read by Ralph H. Green, O.D., Massachusetts College of Optometry, Boston.

Tuesday, December 14, 1954. 9:00 A.M.—11:00 A.M.

Fundus Photography—Introduction. V. J. Ellerbrock, O.D., Ph.D., Ohio State University, School of Optometry, Columbus.

Presentation by optometrists of Fundus Photographs with brief Histories. John D. Perry, Jr., O.D., Winston-Salem, N. Car.; Monroe J. Hirsch, O.D., Ph.D., Ojai, Calif.; Harold Simmerman, O.D., Pennsylvania State College of Optometry, Philadelphia, and Jack Prince, O.D., Department of Ophthalmology, Medical School, The Ohio State University, Columbus.

Disappearance of Chronic Blepharitis—A Case Report. Paul L. Connolly, O.D., Detroit.

Congenital Cataract in a Six Generation Pedigree. H. A. Jankiewicz, Ph.D., and Dale D. Freeberg, O.D., Los Angeles College of Optometry, Los Angeles.

Dr. Monroe J. Hirsch served as chairman of the Section and presided at the sessions.

NEW MEMBERS

Prior to the annual meeting, a class of candidates for Fellowship in the Academy assembled at the College of Optometry of Ontario to complete their clinical and written work under the supervision of Dr. Harold Simmerman, general chairman, Committee on Admittance, and the four regional chairmen, Drs. O. L. McCulloch, Arthur Kitchen, E. E. Reese and Otto J. Bebber. The successful candidates were:

Dr. G. M. Banks, 214-A Sixth St., Gadsden, Alabama.

Dr. Paul S. Blum, Equitable Bldg., Lancaster, Ohio.

Dr. Harold Brande, 1218 13th St., Altona, Pennsylvania.

Dr. Marilyn Brenne, 806 Marshall St., Manitowoc, Wisconsin.

Dr. Samuel S. Campbell, 312 Sinclair Bldg., Steubenville, Ohio.

Dr. Lawrence O. Clegg, 241 Main St., Norwich, Connecticut.

Dr. Paul Ellin, 21 Hamilton St., Peterson, New Jersey.

Dr. G. C. Fitzgerrall, 3878 S. Western Ave., Los Angeles, Calif.

Dr. Richard H. Fuller, 603 Keith Theatre Bldg., Syracuse, N. Y.

Dr. William M. Gabel, 1051-A Linden Ave., Dayton, Ohio.

Dr. Morris Greenberg, 643 Wood St., Vineland, New Jersey.

Dr. Bradford F. Holt, 590 Main St., Lynnfield Centre, Mass.

Dr. Richard L. Hopping, 2676 Salem Ave., Dayton, Ohio.

Dr. Lester Ray Loper, Division of Optometry, Indiana University, Bloomington, Indiana.

Dr. James Miller, 14000 Strathmoor Ave., Detroit, Michigan.

Dr. Wayne Northrup, 109 E. Main St., McConnellville, Ohio.

Dr. Clarence D. Omans, 619 Michigan Bldg., Battle Creek, Mich.
Dr. J. I. Rodgin, 306 Bland St., Bluefield, West Virginia.
Dr. Arthur M. Scherr, 75 State St., Albany, New York.
Dr. W. B. Stevens, 1439 W. Third St., Dayton, Ohio.
Dr. Richard B. Studebaker, 2525 Farhills Ave., Dayton, Ohio.
Dr. Lester L. Thomas, Stadium Bldg., Woonsocket, Rhode Island.
Dr. Ralph L. Ueberall, 88 Fourth Ave., Bayshore, New York.
Dr. A. C. Wilhelm, Jr., 212½ N. Andrews Ave., Fort Lauderdale, Florida.
Dr. Arthur G. Wright, 137 W. Louther St., Carlisle, Pennsylvania.

The Academy welcomed these new members at the annual Round Table Banquet.

EXECUTIVE COUNCIL ACTIONS

The executive council, along with a number of interested members, held several sessions before and during the educational sessions. Much of real value to optometry was accomplished. Among the more significant actions were the following:

* The announcement was made that Dr. Albert Fitch, president of the Pennsylvania State College of Optometry, was the 1955 recipient of an Honorary Life Fellowship in the American Academy of Optometry. The presentation of this bi-annual award, to Dr. Fitch, the distinguished educator and founder of Pennsylvania State College of Optometry, will be made at the next annual meeting of the Academy in December, 1955, at Chicago.

* The Executive Council approved a recommendation that the Academy sponsor a "Memorial paper and award" on a bi-annual basis, the first medal and award to be made in December, 1956, at Houston, Texas. This action was taken following the presentation of a committee report on this subject by Dr. Henry Hofstetter, chairman of a committee that had been reviewing the matter for some time. The other members of the committee were Dr. Glenn A. Fry, Dr. Gordon Walls and Dr. John D. Perry, Jr.

* One of the most important roles of the Academy is furtherance and promotion of education for Optometry. To the present time, this role has been met by the presentation of a wide variety of original papers at the national and sectional meetings, publication of original papers, editorials, book reviews, etc., in this Journal, and sponsorship of research projects through grants-in-aid. The Academy now plans to enlarge its services.

For some time it has been realized that graduate courses sponsored

by the Academy would serve a very useful purpose. For this reason, the Academy appointed a committee one year ago to study and review this possibility and report at the annual meeting in 1954. This procedure was followed and the recommendation made that such courses be inaugurated in conjunction with but prior to the next annual meeting. This recommendation was accepted by the Executive Council; steps then were taken so that courses might be realized at the next annual meeting. The courses will be open to all optometrists.

The courses would vary in length from one to twelve clock hours. In order to achieve a wide selection, an attempt will be made to keep the courses as short as possible. For courses exceeding six hours, participation of more than one instructor is recommended. At the present it is felt that all courses probably can be offered in two or three days preceding the regular annual meeting.

Members of the American Academy of Optometry will qualify as instructors and offer one or more courses. By this means, it is hoped that the vast reservoir of knowledge, skills and methods in the Academy will be readily available to all optometrists.

The Executive Council appointed V. J. Ellerbrock, Ph.D., The Ohio State University, School of Optometry, Columbus, as chairman of the Committee on Instruction, and D. G. Hummel, O.D., Cleveland, chariman of the Committee on Administration for the coming Academy Postgraduate Courses.

* After considerable discussion in which a number of Academy members participated, the Executive Council with regret prepared a statement condemning an unsigned editorial in the November, 1954, issue of the SOUTHERN OPTOMETRIST. In the judgment of the Council, the editorial improperly attacked one of our Honorary Life Members, and unless answered would probably cause friction between ophthalmology and optometry. The statement by the Council is presented as the editorial in this issue of the Journal.

* After receiving the report of the Research Projects Committee, the Executive Council approved four grants-in-aid for 1955. These Academy grants-in-aid were awarded as follows: University of California, School of Optometry. Project under direction of Dr. Merton C. Flom. Amount $750.00; Los Angeles College of Optometry. Project under direction of Dr. G. C. Fitzgerrall. Amount $125.00; Practitioner grant to Dr. Monroe J. Hirsch. Amount $300.00; Los Angeles College of Optometry. Project under the direction of Dr. Max Schapero. Amount $337.97. Reports of these research projects will be presented in a future issue.

* The Executive Council voted to add subnormal vision and its correction to the work of the Contact Lens Section, whose clinical program in the future will cover both subjects. The Contact Lens Examining Board will continue its work as in the past.

ROUND TABLE DINNER

The formal annual Round Table Dinner was one of the high points of the meeting. The banquet was typically British from beginning to end, and the food, service and pageantry were excellent.

Dr. Meredith W. Morgan, Jr., concluded his duties as president by presiding at this affair. Toasts were presented to the Queen and to the President, and a notable list of distinguished persons at the head table were presented to the dinner guests.

Dr. Samuel L. Brown, president of the American Optometric Association spoke on the many favorable aspects of optometric activity and urged all optometrists to work together towards common goals of optometric progress.

Dr. John W. Fisher, radio commentator for C. B. S., stressed the interdependence of Canada and the United States, and pointed out that the friendship of these two great powers was a strong rallying point for the benefit of mankind everywhere.

CHAPTER LUNCHEON

Dr. Lawrence Fitch, Dean, Pennsylvania State College of Optometry, presided at the Chapter Luncheon and presented a new manual that reviews the place Chapters have in the lives and practices of Academy members. The luncheon was held Sunday noon and representatives of most Chapters were present. The manual was well received and will appear in full in a coming issue of this Journal.

CONCLUSION

Our Canadian members were most helpful in making the meeting successful. The wives of Toronto optometrists entertained the women guests at a luncheon and the Toronto committee were on hand at all times to assist in making the four day program run smoothly. In every respect the 34th annual meeting of the Academy, as held in Canada, made all those who attended look forward to another visit to that great city on the shore of Lake Ontario. To our Canadian members we extend our sincere thanks and we say again, that you made us feel at home in Canada. And, too, we hope that you all will be with us at our 1955 meeting in Chicago, the Drake Hotel, December 10-13.

CAREL C. KOCH

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# CURRENT COMMENTS

Terry Judith Parkins
Editorial Assistant

Optometrists will confer a favor by sending news items of general interest for this department; such as relate to new instruments, clinical techniques, education, visual health and optometric legislation and organization.

## CHICAGO COLLEGE RECEIVES IMPORTANT BEQUEST

The Wolfe Foundation, Marshalltown, Iowa, has announced a grant consisting of the patents, rights and title, including all interest, in the Wolfe Scleral Tonometer, heretofore held by the Foundation, to be transferred to the Chicago College of Optometry. In the past the profits on instruments sold to ophthalmologists and optometrists accrued to the Wolfe Foundation. In the future the profits will accrue to the Chicago College of Optometry. This important bequest was made in honor of Otis R. Wolfe, M.D., ophthalmologist, who died during 1954. At the Chicago College of Optometry Board of Trustees meeting, December 16, 1954, the Board accepted the grant, and will supervise the distribution of instruments in the future. The Grant was announced at the Board meeting by Dr. Henry L. Wolfe, Marshalltown, on behalf of himself and his brothers in honor of their father.

Dr. Eugene W. Strawn, Freeport, Illinois, was elected chairman of the Board of Trustees of Chicago College of Optometry at the December 16 meeting. Dr. Strawn replaces Dr. Samuel Hauser, Chicago, who had served as chairman since the death of Dr. Rubin Seid in 1951. The new officers of the Board in addition to Dr. Strawn are, Dr. Henry L. Wolfe, Marshalltown, secretary, and Dr. Hauser, Chicago, treasurer. At the same meeting Dr. Rudolph Ehrenberg, Granite Falls, Minnesota, was elected to the Board and Dr. Oscar Weinstein, Rockford, Illinois, was re-elected to the Board. The other member of the six man Board is Dr. Carel C. Koch, Minneapolis. Dr. Morton Abram, Chicago, is president of the College and Dr. Eugene Freeman, Chicago, is Dean.

## FISHER HEADS NATIONAL BOARD

The dates of June 23-25, 1955, have been announced for the fourth annual examinations to be given by the National Board of Examiners in Optometry at all of the accredited schools and colleges of optometry. This announcement followed a meeting of the seven member Board in Chicago on December 9-10.

New officers elected for the year 1955 are Dr. Harold M. Fisher, New York City, president; Dr. Bruce Jaques, Los Angeles, vice-president, and Dr. John R. Uglum, Mitchell, South Dakota, secretary-treasurer.

Other business taken up at this meeting included considerations of a pre-professional selection test for optometry, a review of candidates' records from the 1954 examinations, adoption of a new rating scale for the Part III practical examination, the preparation of outlines of subject matter to be included in each Section of the National Board Examinations, and a conference with Dr. Clarence Strobel, Secretary of the International Association of Boards of Examiners in Optometry.

Dr. Richard Feinberg, president, Northern Illinois College of Optometry, was appointed to represent the National Board in a forthcoming conference with representatives of several other optometric organizations to study the statistical interrelationship of National Board scores with performances of candidates on individual state boards.

## WALTER IRVING BROWN SECTION MASSACHUSETTS COLLEGE LIBRARY

Dr. Ralph H. Green, dean of the Massachusetts College of Optometry, recently announced the establishment of the Walter Irving Brown Section of the College Library. Dr. Brown, a practicing optometrist since 1907, has donated his entire professional library to the College. Dr. Brown is well known nationally for his leadership in optometry, having served on the Massachusetts State Board of Registration in Optometry for thirty years, as chairman for fifteen years and secretary for ten.

He is also a past president of the American Optometric Association, New England Council of Optometrists, Massachusetts Society of Optometrists, American Academy of Optometry, and American Research Council of Optometrists. He served as chairman of the Council on Education and Professional Guidance of the A. O. A., playing an important role in the advancement of optometric education. Dr. Brown received the first honorary degree of Doctor of Ocular Science conferred by the Massachusetts College of Optometry in June, 1952.

## INTERPROFESSIONAL HEALTH CONFERENCE IN NEW YORK CITY

The second annual Interprofessional Health Conference, sponsored by Omega Epsilon Phi and the Columbia University Optometry Alumni Association will be held at the Hotel Roosevelt, New York City, Sunday, February 13, 1955. The co-chairmen of this year's event are, Bernard Meyer, O.D., and Alfred J. Asgis, D.D.S., Ph.D., New York City. Speakers on the first panel dealing with, Health Education for Public Safety, are Joseph I. Pascal, O.D., M.D., lecturer in ophthalmology, New York Polyclinic Medical School and Hospital; Milton Henenfeld, Pod.D., assistant professor, College of Podiatry, Long Island University; Walter Schachat, M.D., ophthalmological consultant, New York City Board of Health and Alfred J. Asgis, D.D.S., Ph.D., assistant

professor, New York University, College of Dentistry.

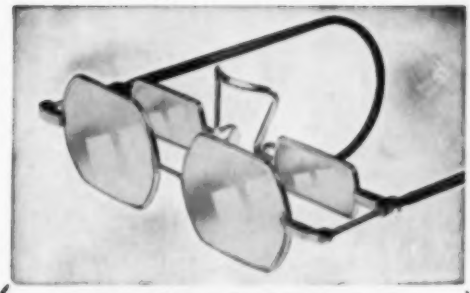
On the second panel dealing with, Public Safety Through Legislation for Eye-Health, the speakers will be, George Schwartz, M.D., vice-president Bronx Chamber of Commerce; Daniel Woolf, Ph.D., Assistant professor of Optometry, Department of Optometry, Columbia University; Leon Brody, Ph.D., New York University, Safety Education Center; Norman Olman, Director of Highway Safety, Greater New York Safety Council and Lewis R. Morrison, District Safety Director, Lumbermans Mutual Casualty Company. The first panel will start at 12:30 p.m.

WE APOLOGIZE FOR CARELESS MISTAKE

Dr. Hermann J. Raile, Menomonie, Wisconsin, writes, "I am very certain that my good friend John Margetts of Galway, Ireland, and all the citizens of Eire will be quite perturbed to find his address listed in North Ireland in the [Academy] geographic directory. I had the pleasure of visiting at his home during the past summer. He probably would not mention the item himself but Irish feeling in general will probably look upon it as somewhat naive if not unflattering." To Academy members Margetts and Raile our regrets at this error, and our promise to move Galway back into Ireland in our 1955 directory.

NEWS BRIEFS

The ninth Southwestern Optometric Visual Training Assistants' meeting will be held February 12-13, Hotel Texas, Fort Worth. This session, for orthoptic technicians, is part of the O.E.P. training program and precedes the annual Southwest Congress of the Optometric Extension Program. . . . Dr. John R. Kennedy, president, Northern Illinois College of Optometry Alumni Association, announces that a national alumni reunion will take place at the college in Chicago, July 10, following the annual meeting of the American Optometric Association in Milwaukee. . . . The dates have been announced for the International Optical Congress in Dublin, Ireland. These are July 11-15. . . . A new occupational vision folder has been announced by the A. O. A. It is entitled "Do You Know These Facts About Vision and Your Job." Copies may be ordered from the A. O. A. office, 4030 Chouteau Ave., St. Louis 10, Missouri. . . . The first eastern Canada Congress of the O. E. P. will be held at the Mount Royal Sheraton Hotel, Montreal, May 22-24. . . . William R. Baldwin, O.D., has been appointed instructor in optometry at Indiana University, Division of Optometry. . . . Mr. G. H. Giles has been re-elected president International Optical League.



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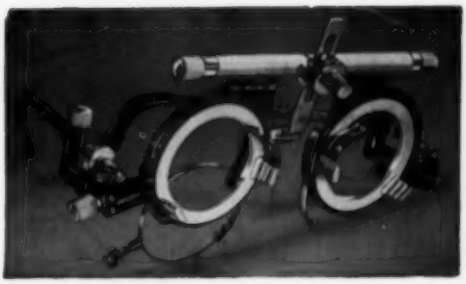

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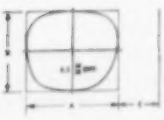

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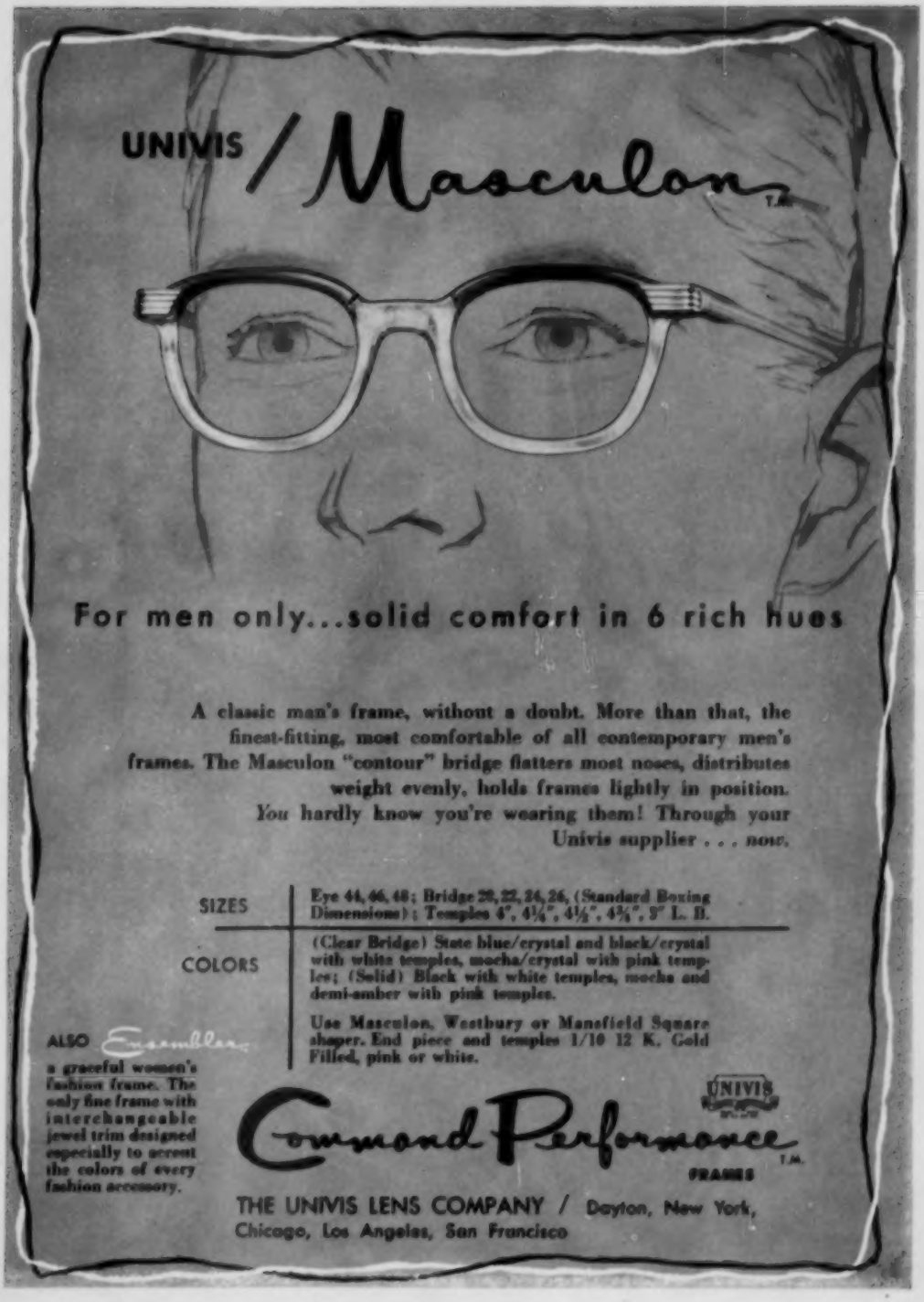
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